FIFTEENTH AIRCRAFT PRODUCTION NUMBER – JUNE 1955

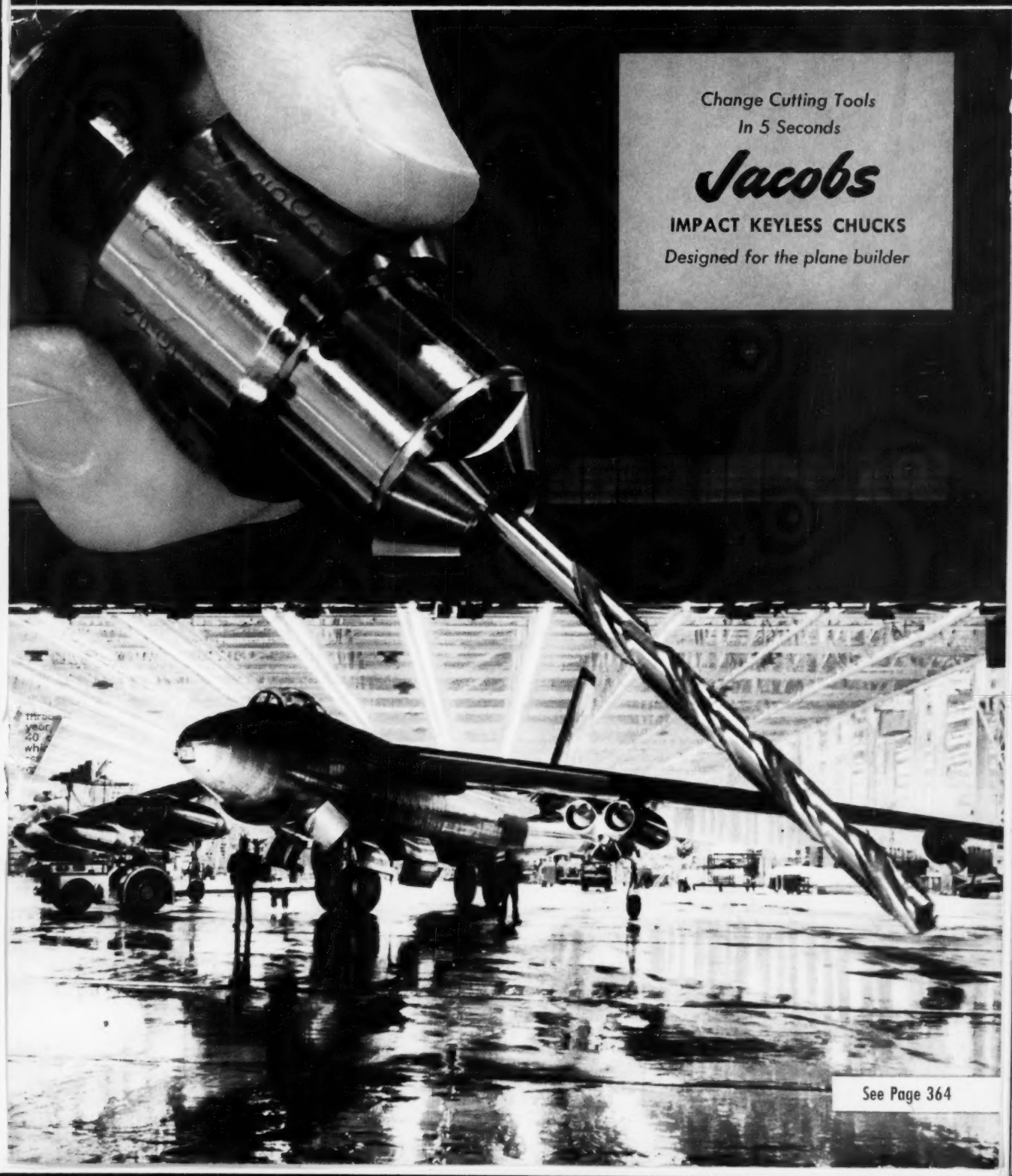
MACHINERY

Change Cutting Tools
In 5 Seconds

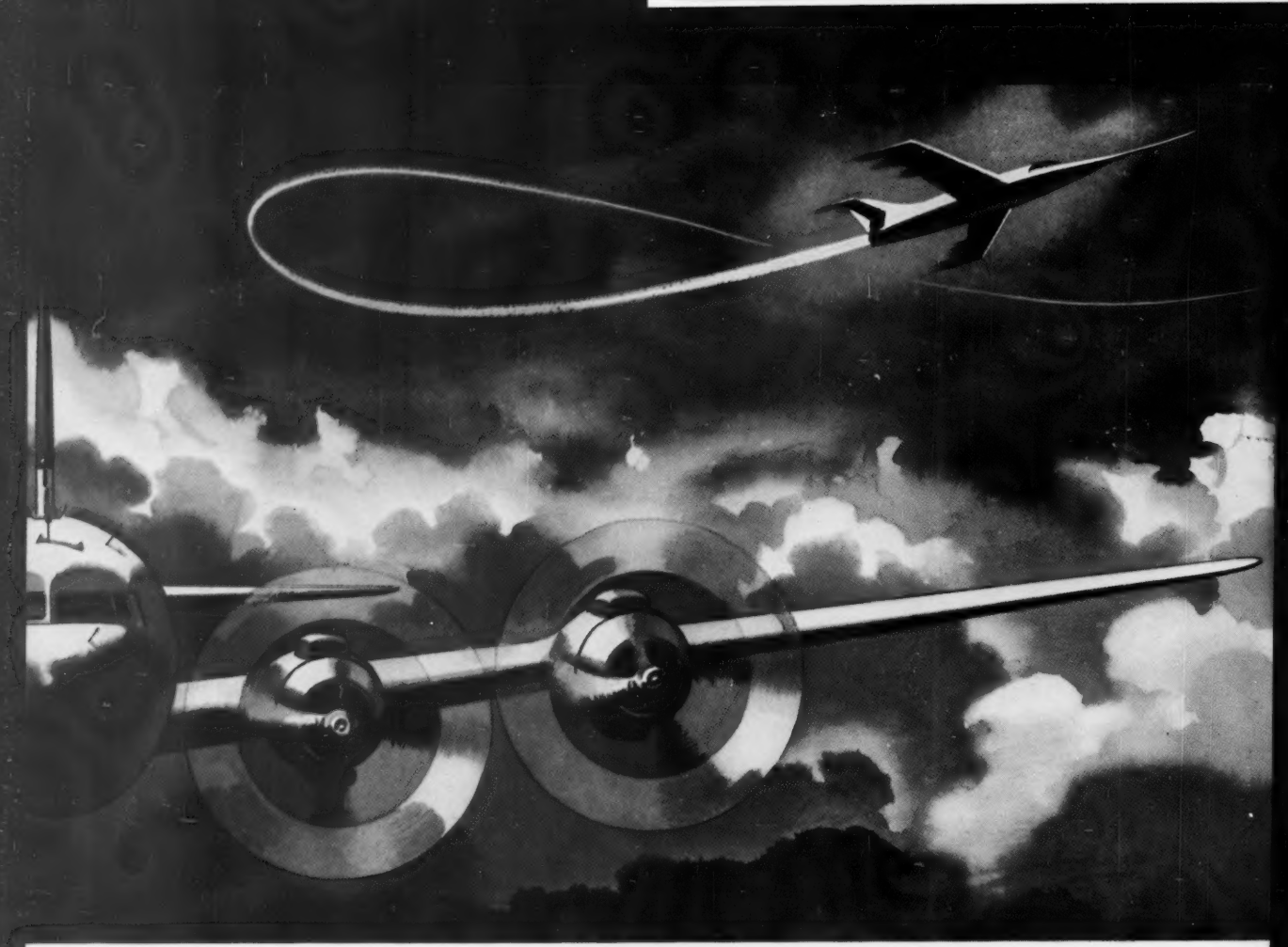
Jacobs

IMPACT KEYLESS CHUCKS

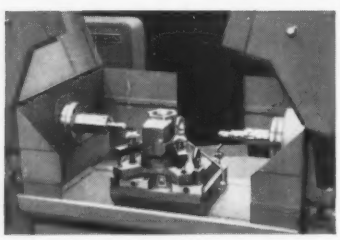
Designed for the plane builder



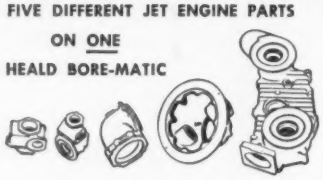
See Page 364



the finest precision parts are finished on Heald machines



FIVE DIFFERENT JET ENGINE PARTS
ON ONE
HEALD BORE-MATIC



The Model 322 Bore-Matic shown above borizes critical surfaces on five entirely different jet engine components — each with a different fixture and tooling setup. Easily interchangeable fixtures and boring tools enable this one machine to perform a variety of semi-finishing and finishing operations on the different parts — with minimum down-time for changeovers.

From supersonic jets to commercial airliners — *precision* is vital to sustained flight, accurate navigation, safe landings and take-offs. That's why so many aircraft parts today are precision finished on Heald Bore-Matics, Internals and Rotary Surface Grinding Machines.

Jet engines, reciprocating engines, propeller parts, landing gear, aircraft instruments, sighting devices and guided missiles—all require the extreme accuracy and precision that have become almost a tradition with Heald machines.

Whether the job calls for long runs or frequent changeovers, you'll get maximum precision plus maximum production on a Heald. Moreover the aircraft industry is just one of many where new Heald equipment is paying off *right now* in terms of lower costs, larger profits and better product. May we serve you, too?

it PAYS to come to Heald

Booth 902
AT THE MACHINE TOOL SHOW

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Paris-IXe, France

MACHINERY

VOLUME 61 JUNE, 1955 NUMBER 10

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

"Chem-Mill" on a Production Basis at North American — *By Manuel Sanz* 156

Forging Delta Wing Spars on a 35,000-Ton Press — *By Edgar Altholz* 164

Producing Allison Turbo-Prop Engines ..... *By J. C. Fetters* 170

Unique Machines Perform Operations on Jet-Engine Parts — *By Lawrence M. Limbach* 178

Douglas Equipped for Building Sonic and Supersonic Aircraft — *By T. E. Springer* 184

Precision Forging of Jet-Engine Blades .... *By Edward B. Wells* 192

Convair Procedure in Quality Welding ..... *By Fred Monahan* 200

Model Machine Shop Serves Boeing Wind Tunnel 204

Northrop Missiles Made to Optical Accuracy 206

Innovations in Jet-Engine Manufacture .... *By Ernest W. Bartle* 210

Synthetic Cutting Compound with Exceptional Properties 219

Ultrasonic Machine Cuts Precision Holes in Hydraulic Sleeves — *By William W. Wood* 220

Recommended Temperatures for Preheating Metals Prior to Welding (Data Sheet) 259

MANAGEMENT PROBLEMS AND EVENTS

Senate Committee Reviews Leasing of Machine Tools — *By Loring F. Overman* 151

Why the Aircraft Industry Enjoys Peacetime Prosperity — *By Charles O. Herb* 153

U. S. A. F.-Alcoa Plant Goes into Operation 222

Machine Tool Builders Boost September Show 225

Westinghouse Nineteenth Annual Machine Tool Electrification Forum 227

Interest Will Germinate But How Will It Terminate? — *By Bernard Lester* 229

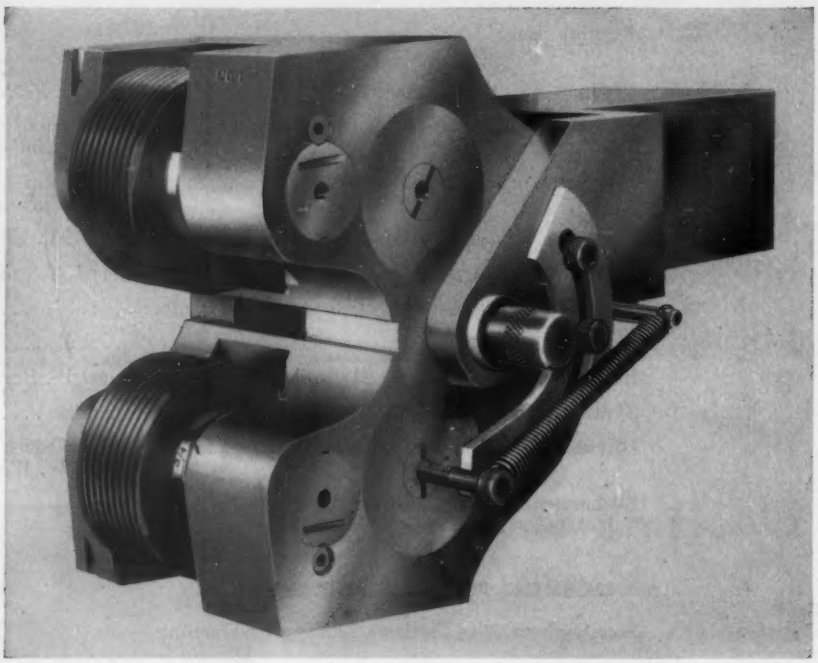
DEPARTMENTS

Keeping up with Washington 151
Talking with Sales Managers 229
The Latest in Shop Equipment 230
Data Sheet 259
Between Grinds 266
News of the Industry 269
Catalogues 277
Coming Events 282

Product Directory
320

Advertisers Index
447-448

Coarse Pitch Threads Rolled to Class 4 Fit..



The LANROLL Thread Rolling Attachments offer features designed to ensure greater accuracy, flexibility and economy when producing threads. . . .

1. *PERFECT HELIX AGREEMENT* allows rolling coarse pitch threads to Class 4 tolerances with long roll life. Threads can also be rolled directly to a shoulder with safety.
2. *ADJUSTABLE DESIGN* provides wide range coverage for each attachment size without loss of rigidity.
3. *SUITABLE SIZES* of LANROLL Attachments have been designed for all types and sizes of automatic screw machines and turret lathes with power feed.
4. *RAPID AND PRECISE SET-UPS* are possible with special gaging methods designed for easy use and the elimination of "cut-and-try" set-ups.
5. Five sizes of Attachments roll a wide range of threads:
   #14—#5 to ⅜"; #18—#5 to ½"; #20—¾" to 1"
   #22—⅝" to 1¼"; #24—¾" to 1¾"

Other outstanding advantages of these LANROLL Attachments include: behind-the-shoulder threading; taper correction; and excellent thread finish and microstructure. For additional information ask for Bulletin G-96—please send specifications when writing.

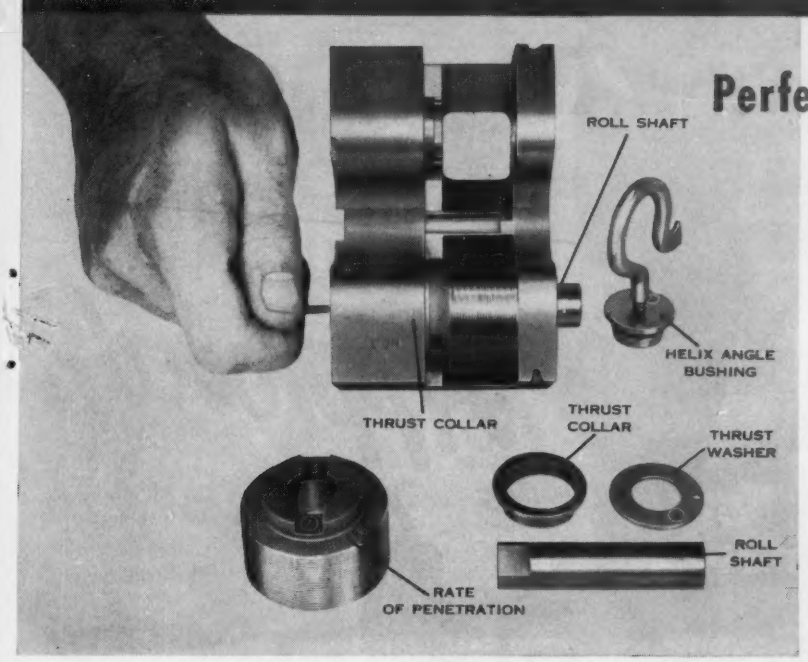
LANDIS *Machine* COMPANY

423-c

WAYNESBORO • PENNSYLVANIA • U. S. A.

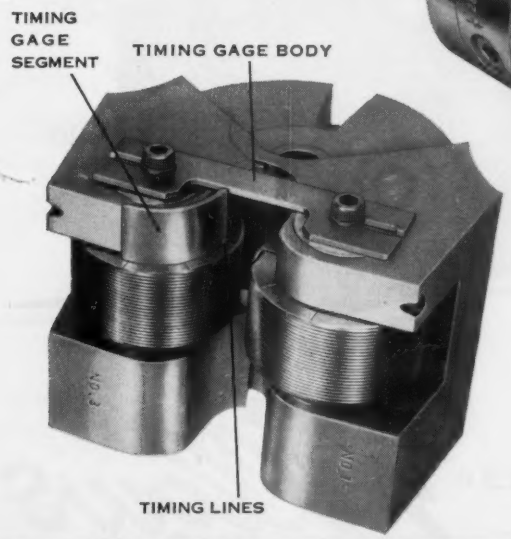
Perfect Helix Agreement

The helix angle bushings, thrust collars, and thrust washers provide a corrective between the workpiece and roll helixes, eliminating drunkenness and ensuring coarse pitch threads to Class 4 fit. All helix angle equipment is designed and marked for rapid changes.



Infinite Size Adjustment

Size adjustment links are used for major adjustments, with final sizing controlled by size adjusting screws. This system, and changing helix angle bushings, assures rolling all threads as though the attachment were exclusively engineered for that particular work.



Precise Timing

A simplified system of roll timing ensures satisfactory rolling on the first operation. Only one gage is used for timing all threads rolled by each attachment. Rolls are correctly timed when roll lines coincide with the vertical of the curved timing gage segment (illustrated).

FELLOWS 7A-TYPE GEAR

7A *Approved*

CALL IN a Fellows Representative for complete information about the Fellows "line-up" ... as well as facts about the Fellows Plan for deferred payment. WRITE, WIRE or PHONE any Fellows Office!

THE *Fellows*

SHAPER . . .

by Gear Men for 1955

Dollar for dollar, pound for pound . . . the Fellows No. 7125A Gear Shaper has long proved a sound investment for *any* shop that requires high-speed gear production within its size capacity. This machine scores high on all counts:

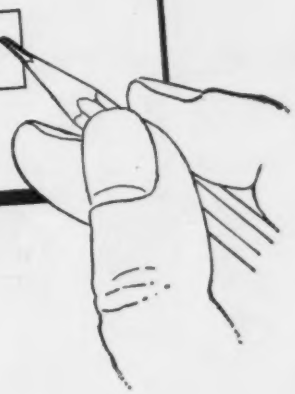
VERSATILITY . . . produces spur and helical external gears up to 7″ pitch diameter, 2″ face width . . . internals up to 6″ p.d. . . . medium coarse or fine pitch . . . cams, ratchet teeth, segment gears, face gears by using a special attachment, interrupted profiles and other special contours. ✓

SPEED . . . has earned an outstanding reputation for cutting down production costs on both long and short runs . . . can be fitted into new concepts of high-speed automation. ✓

PRECISION . . . features rugged construction to assure close tolerances even while taking substantial cuts . . . provides the kind of precision for which the Fellows Method is famous throughout industry. ✓

FAST SET-UP . . . and rapid change-over allows you to get more production. Especially advantageous for shops handling short runs. ✓

DEPENDABILITY . . . like *all* Fellows Gear Shapers . . . the No. 7125A assures an extraordinarily high level of performance on job after job . . . month after month. ✓



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Head Office and Export Department: 78 River Street, Springfield, Vermont.
Branch Offices: 319 Fisher Building, Detroit 2 • 5835 West North Avenue, Chicago 39
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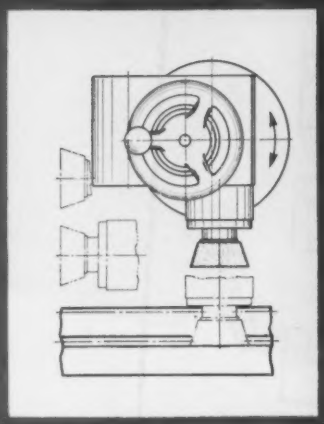
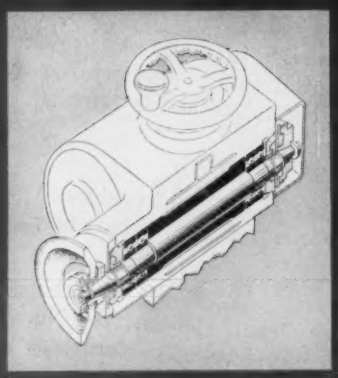
Your Production Machines Will do a ... with this NEW CINCINNATI ... on the Supporting Team

Production slops and expenses skyrocket when your line—or even a single machine—shuts down because there are no replacements for dull cutters. You can avoid these ruinous delays by making sure that correctly sharpened cutters are immediately available when needed, and the best machine to gain this assurance for small- to medium-size cutters is the new CINCINNATI No. 1 Cutter and Tool Grinder. ¶These new and highly efficient machines are easy and convenient to operate, and they incorporate the versatility required to accurately grind a wide variety of cutters. The smaller illustrations show some of the reasons why. Would you like to know more? Just ask for Catalog No. M-1852.

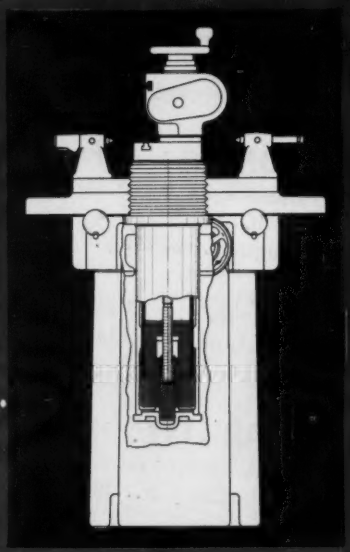
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



Extra Range—360° eccentric swivel of the wheelhead provides 3" cross adjustment of the grinding wheel position. This is in addition to the standard cross range.



No Servicing—the grinding wheel spindle runs on preloaded, precision anti-friction bearings, lubricated for life.



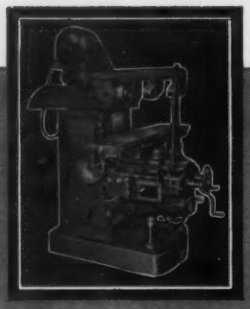
Anywhere You Say—In addition to 360° swivel range, the wheelhead pile may be adjusted vertically to suit the cutter being sharpened.

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

CINCINNATI

New CINCINNATI No. 1 Cutter and Tool Grinder. Complete data may be obtained by writing for catalog No. M-1852.



Why Buy Two When

ONE VAN NORMAN Ram Type Miller

Gives You the Workability of Two Single-Purpose Machines

Increases Your Production... Cuts Your Investment Costs!

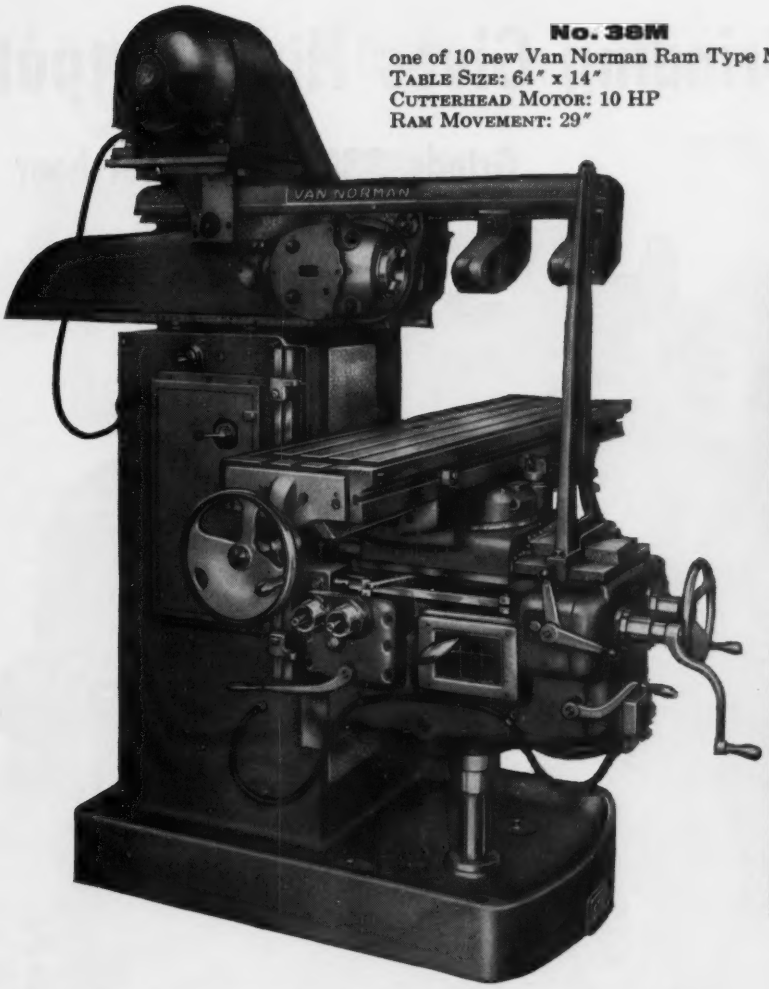
Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

VAN NORMAN

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

No. 38M
one of 10 new Van Norman Ram Type Millers
TABLE SIZE: 64″ x 14″
CUTTERHEAD MOTOR: 10 HP
RAM MOVEMENT: 29″

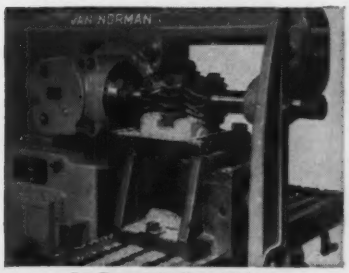


For the price of *one* Van Norman Ram Type Milling Machine without attachments, you get the workability of two single-purpose millers with attachments. This means you save on capital expenditures, yet do not cut down on production.

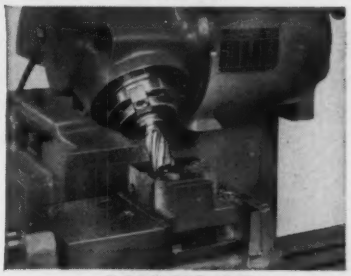
With the Van Norman Miller you do horizontal, vertical, as well as angular milling on one machine. The result — you keep the miller working at capacity every shift. You eliminate idle machine and worker time . . . increase production.

Ten new models with cutterhead motors ranging from 1½ HP to 10 HP and table sizes from 37½″ x 9³⁄₁₆″ to 64″ x 14″ give you a wide range of selection. Write for complete information, today.

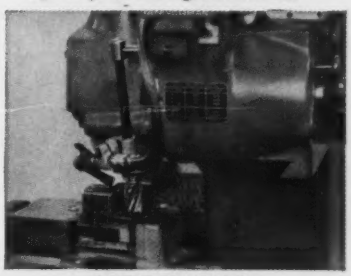
HERE'S HOW IT WORKS



HORIZONTAL
A heavy horizontal milling cut performed on the miller. Over-arm and outer brace provide maximum rigidity and accuracy.



ANGULAR
An angular milling operation is being performed on a workpiece. Angular range of cutterhead is 0 degrees to 90 degrees. Accurate positioning is simplified by easy-to-read graduations.



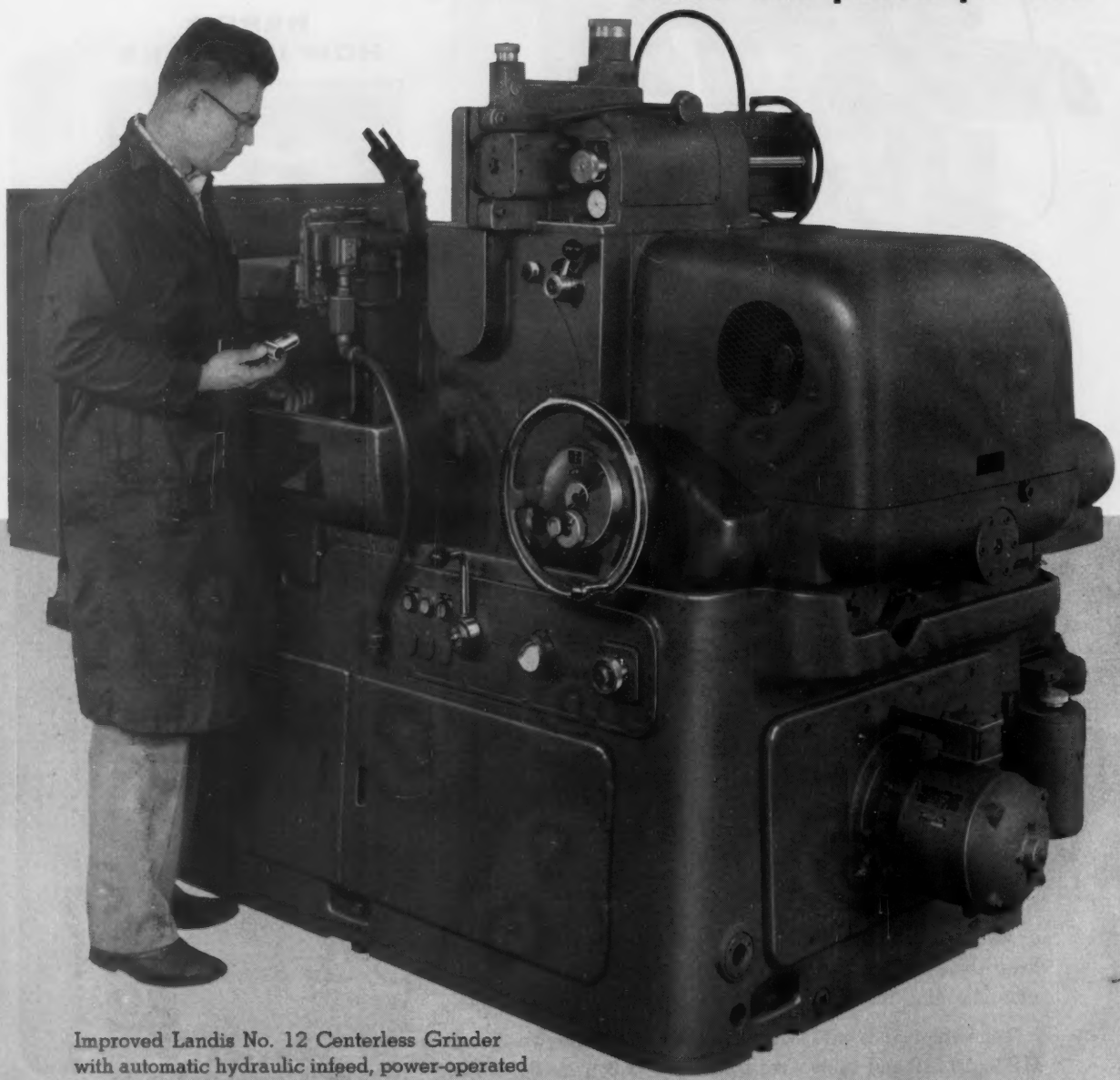
VERTICAL
With the cutterhead locked in the vertical position, a vertical milling operation is performed on the work piece.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Automatic Grinding Gives High Output...

Grinds 380 pistons per hour

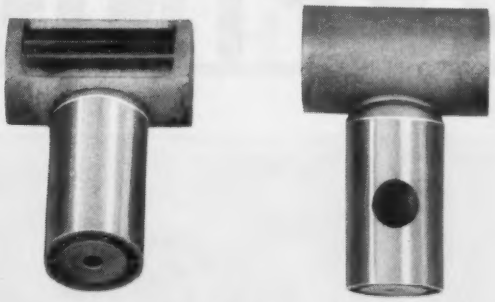


Improved Landis No. 12 Centerless Grinder with automatic hydraulic infeed, power-operated loader and spark-out timer. Perhaps a loader of this type could be applied to your work to reduce costs. Send us your data for production estimates.

LANDIS

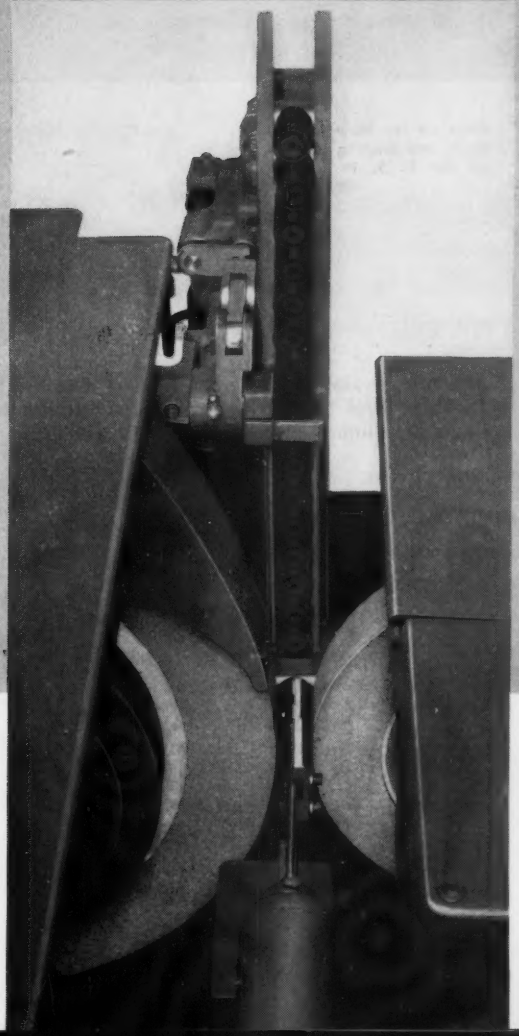
precision grinders

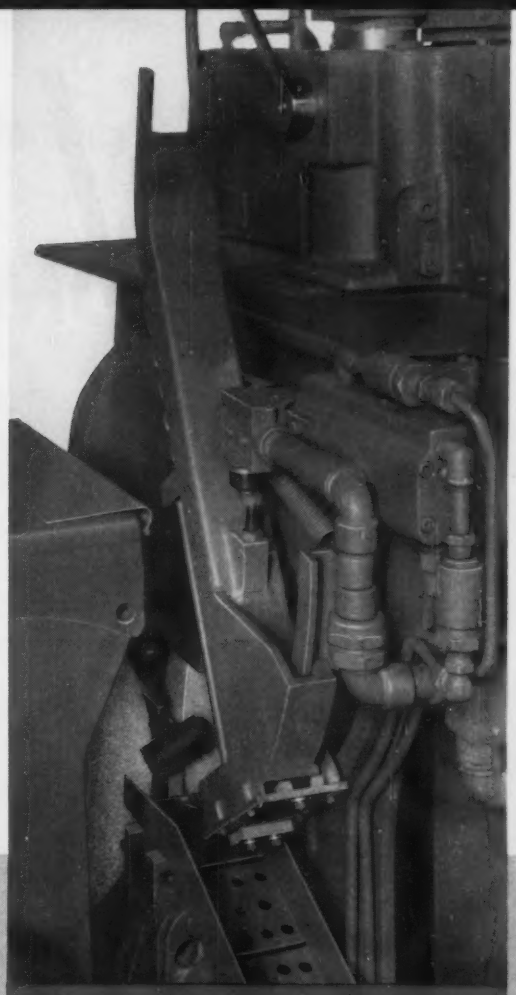
...Low Unit Costs



- Power-operated loader feeds pistons . . . operator stacks work in feed chute.
- Hydraulic infeed automatically feeds grinding wheel to finish size. Retracts for automatic loading.
- Timer controls spark-out period.

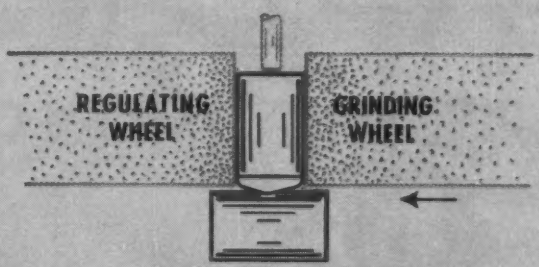
loads and grinds automatically





unloads automatically

- Power-operated loader swings back.
- Work piece is ejected onto discharge chute.



Semi-finish grinds 380 piston assemblies per hour. Stock removal: .005" to .007"

LANDIS TOOL COMPANY

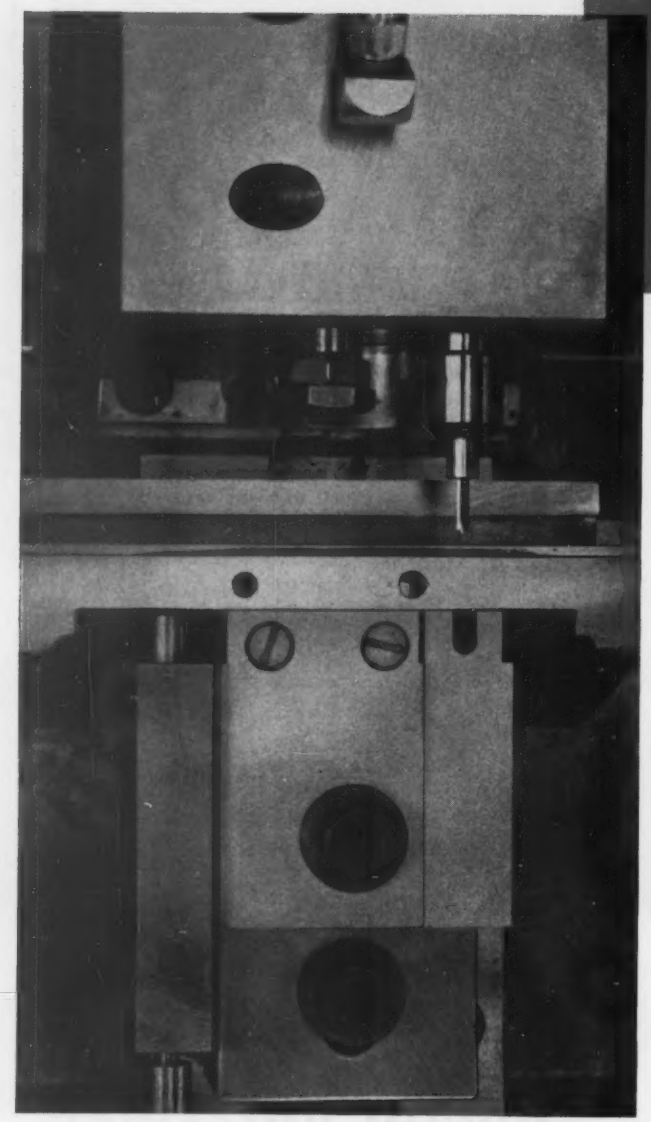
WAYNESBORO, PENNA., U. S. A.

Now!

In Addition to Trimming, Piercing,

TAPPING

Allen-Bradley Co. Part E-10128, Coil Terminal produced complete on a No. 33 U. S. Multi-Slide, including tapping a 6-32 hole. Shown three times actual size.

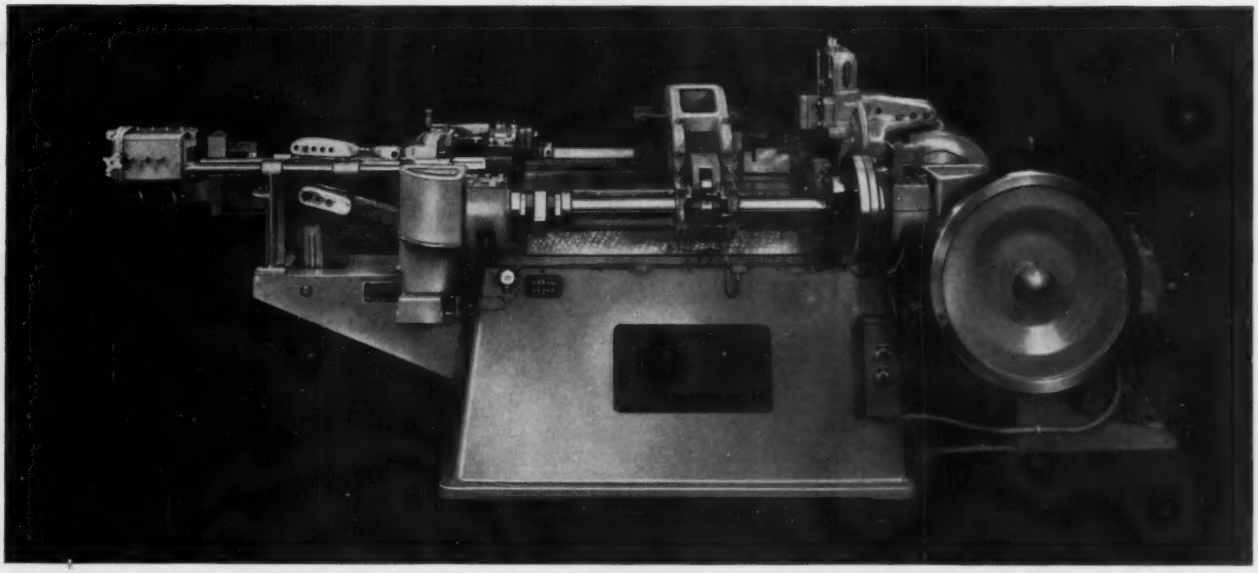


Close up top view looking down into tapping position on the U. S. Multi-Slide.

See this equipment in operation at Booth 215. Machine Tool Show, International Amphitheatre, Chicago, Illinois—September 6-17, 1955.

Swaging, Embossing, Blanking and Forming

ON THE U. S. MULTI-SLIDE!



Standard #33 U. S. Multi-Slide Machine which is used (with the addition of a tapping head) for the production of the Allen Bradley Company part.

The Allen Bradley Company, Milwaukee, Wisconsin, manufacturers of quality motor controls will install in their plant a #33 U. S. Multi-Slide Machine equipped with tapping head to produce a Coil Terminal (shown to the left above) complete including the tapping of a 6-32 hole. The incorporation of the tapping in the Multi-Slide eliminates the need for a secondary operation. The U. S. Multi-Slide is designed and built for the automatic production of stampings, and any or all of the following operations may be incorporated to produce complete parts at each stroke of the machine: trimming, piercing, swaging, embossing, blanking and forming. The possibility of including a tapping operation increases the versatility of the Multi-Slide and offers to the user increased potential for cost reduction by eliminating secondary operations and handlings. U. S. Multi-Slides are available in four sizes. Bulletin #15-M contains complete specifications—ask for a copy.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

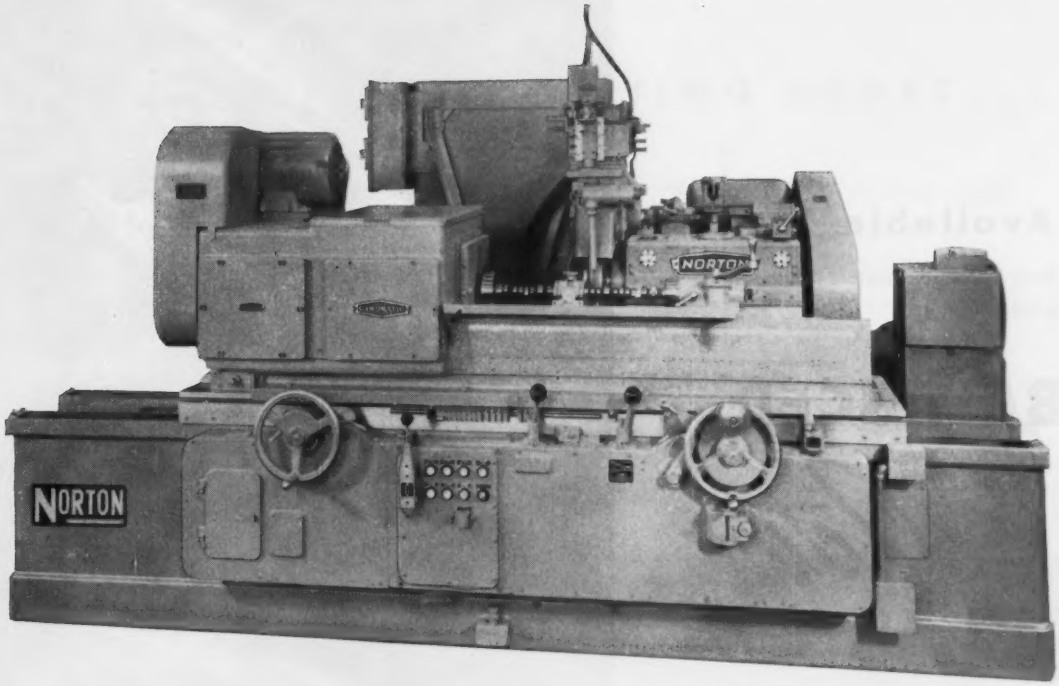
Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

Norton's Newest!

The No. 3 CAM-O-MATIC grinds camshafts better...

BUILT-IN OPERATING SKILL of the No. 3 CAM-O-MATIC Grinder is a typical Norton "Touch of Gold" that adds value and boosts profits. Many automatic features on this greatly improved machine reduce the operator's duties to loading and unloading. He can easily tend two or more machines — while *you* get better grinding for less money.



Highly advanced automatic grinder sets new standards for production, precision and finish

With the No. 3 CAM-O-MATIC Grinder, Norton introduces a new concept of efficiency in camshaft grinding.

No other machine of its type offers you such a combination of exclusive features, rugged construction and simplified operation. No other machine can do more towards stepping up the quality of your camshaft production, while cutting grinding time and costs.

Greater Rigidity Improves Performance

The No. 3 CAM-O-MATIC Grinder features solid, rigid construction that means minimum vibration, more accurate performance and longer service life. Another big advantage for fluid, shockless operation is that the entire operating cycle is geared to split-second efficiency. Indexing is ultra-smooth and extra-rapid. And the wheel-slide retraction after grinding each cam is no greater than maximum stock removal.

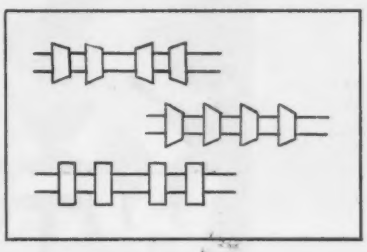
Speed is always right — automatically

The No. 3 CAM-O-MATIC Grinder's automatically compensating work speed arrangement is a valuable aid to faster, more accurate grinding. Starting with the ideal speed for rapid stock removal, it changes to exactly the right speed for fine finishing and contour accuracy — as each cam is being ground. This eliminates guesswork, manual adjustment and lost motion.

Wheel truing is automatic, too

Still another example of built-in operating skill is the wheel truing device, in which the truing diamond is automatically advanced across the wheel face and back, cutting in both directions. This is done while the operator is loading and unloading, so no time is lost. And by removing only just the amount of abrasive required for truing, the working life of every wheel is prolonged.

Your choice of tapers



The swiveling wheel slide — a Norton patent — permits grinding cam tapers in one direction (standard equipment) or tapers in opposite directions on the same shaft (an optional extra). Both arrangements permit straight-face grinding, as well — thus increasing the versatility of your camshaft production equipment.

See your Norton Representative — or write direct — for full details on the No. 3 CAM-O-MATIC Grinder. And remember, only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

***To Economize, Modernize with* NEW**

NORTON

GRINDERS *and* LAPPERS

Making better products... to make your products better

District Sales Offices:
Worcester • Hartford • New York Area, Teterboro, New Jersey • Cleveland • Chicago • Detroit — *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

For more information on products advertised, use Inquiry Card, page 277

Available

from Winter distributors located in principal cities:

BALANCED *Action*

TAPS

Hand Taps
Machine Screw Taps
Chip Driver Taps
Nut Taps
Pipe Taps
Pulley Taps
Nib Taps
and various types of Taps for Special Applications

GAGES

A complete line of Plug and Ring Gages, Threaded and Plain.

DIES

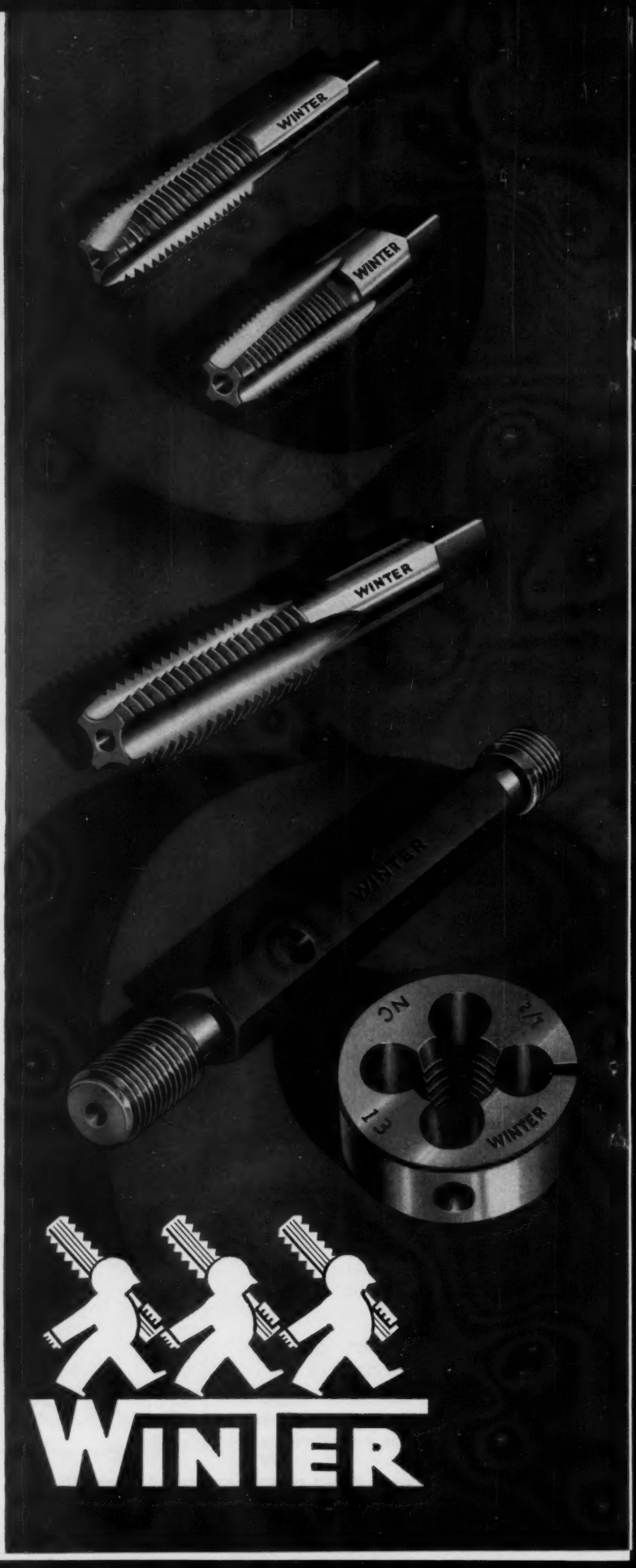
Adjustable Round Split Dies
Hexagon Rethreading Dies
Solid Square Bolt Dies
Solid Square Pipe Thread Dies

PHONE
YOUR WINTER
DISTRIBUTOR

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit Cleveland • Chicago • Dallas • San Francisco Los Angeles

Division of National Twist Drill & Tool Co.



WITH *Dependable* CUTTING EDGES . . .

National milling cutters and hobs, with their dependable cutting edges, are available from Factory and Distributor's stocks. They give you cutting edges for excellent production and long wear.

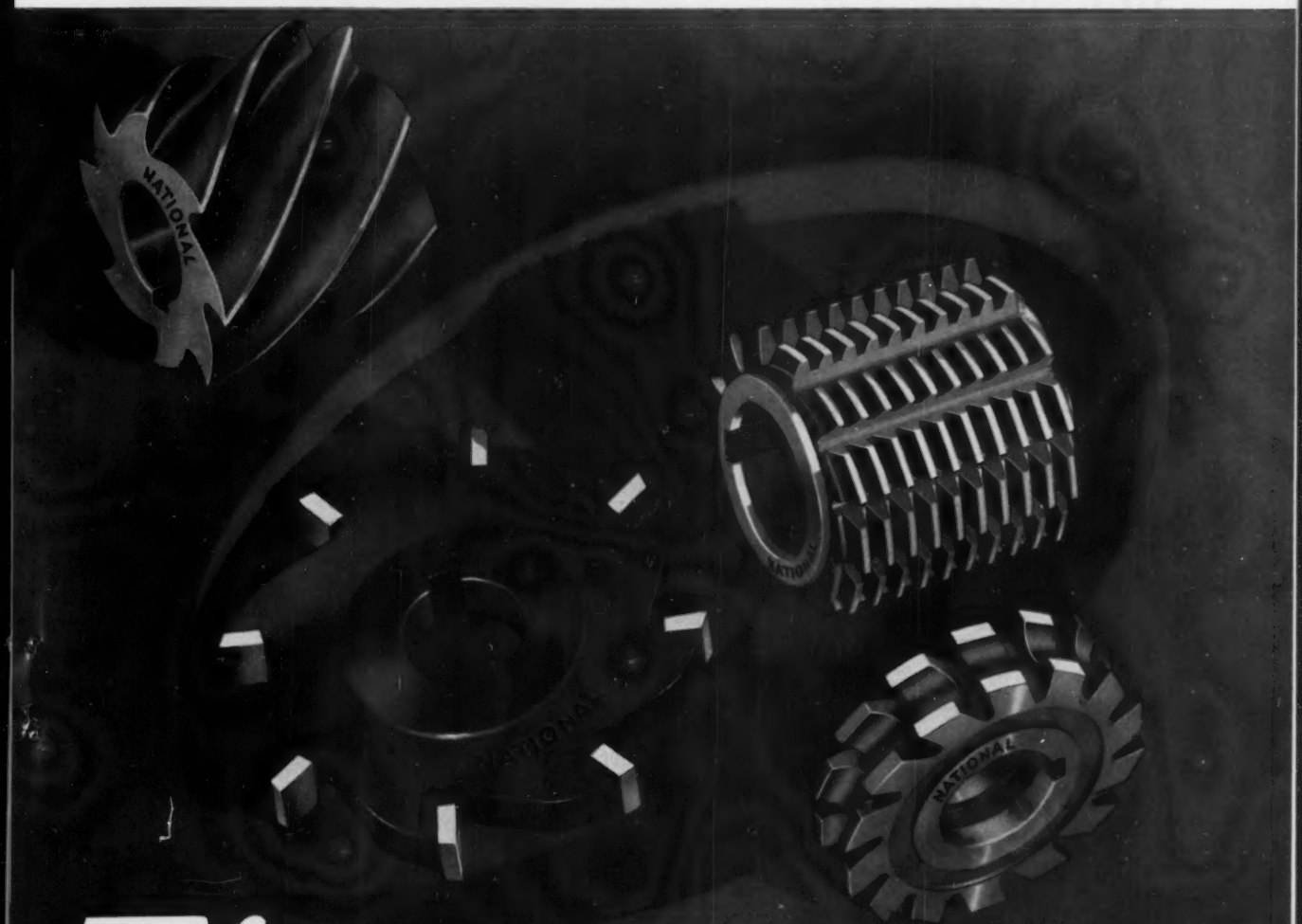
Milling cutters also available with carbide tips.

PHONE YOUR NATIONAL DISTRIBUTOR

NATIONAL TWIST DRILL AND TOOL COMPANY Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

Twist Drills • Reamers • Counterbores • Milling Cutters • End Mills • Hobs • Carbide Tipped and Special Tools

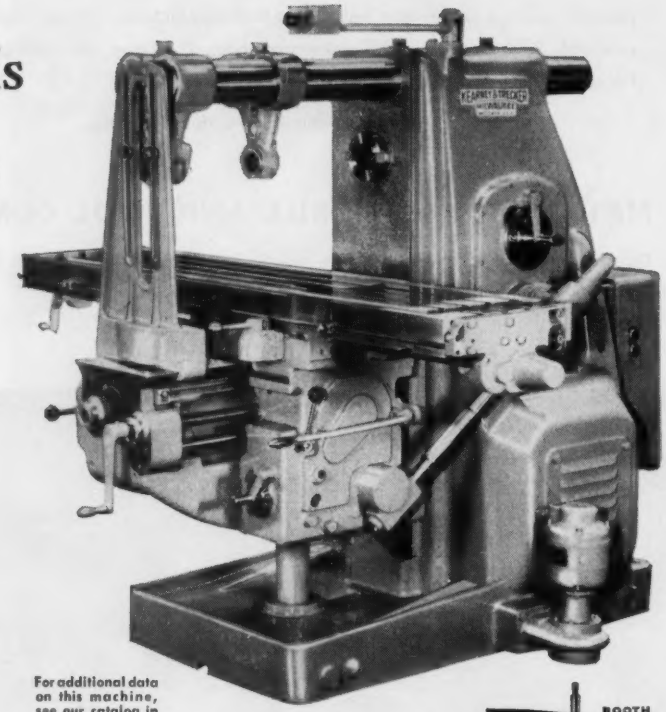


National

NATIONAL TWIST DRILL & TOOL CO. ROCHESTER, MICH., U.S.A.

PAY-OFF PRICE ONLY

when you put this new 7½ hp No. 3 Model CE plain milling machine to work in your plant with...



For additional data on this machine, see our catalog in Sweet's.

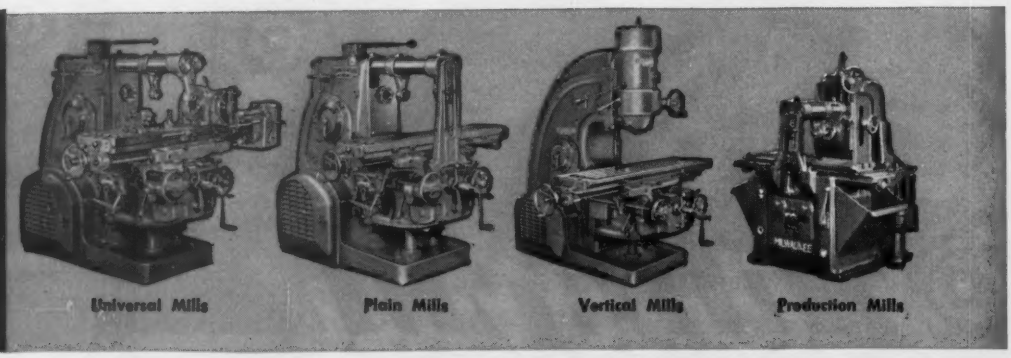
THE MACHINE TOOL SHOW CHICAGO, ILL. BOOTH NO. 508

Kearney & Trecker's

TOOL-LEASE

PROGRAM

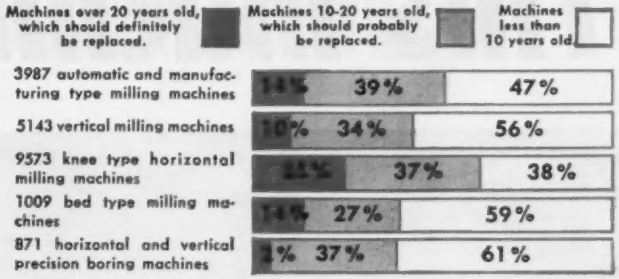
Kearney & Trecker manufactures a complete line of more than 250 standard knee and bed type milling machines and precision boring machines.



27 CENTS PER HOUR...

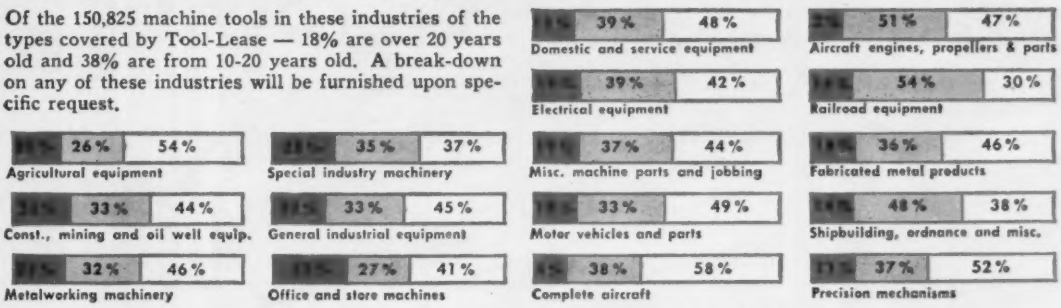
LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE FABRICATED METAL PRODUCTS INDUSTRY

Includes machines for hand tools; hardware; oil burners; structural steel; boilers, sheet-metal, enameled, stamped and pressed metal products; powder metallurgy, wirework; screw-machine products; metal specialties, games, toys, jewelry and sporting goods. Of the total 20,583 machines, 18% are over 20 years old and over 36% are 10 to 20 years old!


Machines over 20 years old, which should definitely be replaced.
Machines 10-20 years old, which should probably be replaced.
Machines less than 10 years old
3987 automatic and manufacturing type milling machines
14% 39% 47%
5143 vertical milling machines
10% 34% 56%
9573 knee type horizontal milling machines
25% 37% 38%
1009 bed type milling machines
14% 27% 59%
871 horizontal and vertical precision boring machines
1% 37% 61%

HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.



Figures adapted from 1953 American Machinist survey of metalworking industry

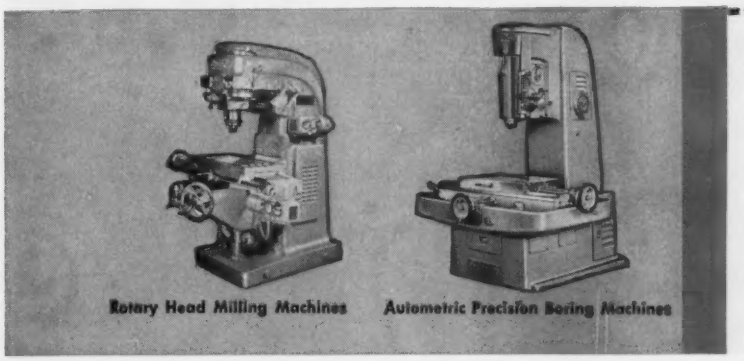
IT'S true! Under Tool-Lease you can lease this new 7½ hp No. 3 Model CE plain milling machine for *only 27 cents per hour.* This Model CE is Kearney & Trecker's answer to industry's need for a milling machine that combines *quality and low initial cost* with efficiency, ease and economy of operation.

Under Plan "A," one of three possible lease agreements, you make two semi-annual payments, totaling 25% of the machine's price during each of the first three years. And only 10% during each of the last four years.

What's more, under Tool-Lease you can rent any of over 250 different types and sizes of standard milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

For complete information on Tool-Lease, see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

©1954



KEARNEY & TRECKER CORP.
6784 W. National Ave., Milwaukee 14, Wis.

Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence."

Name.....

Title.....

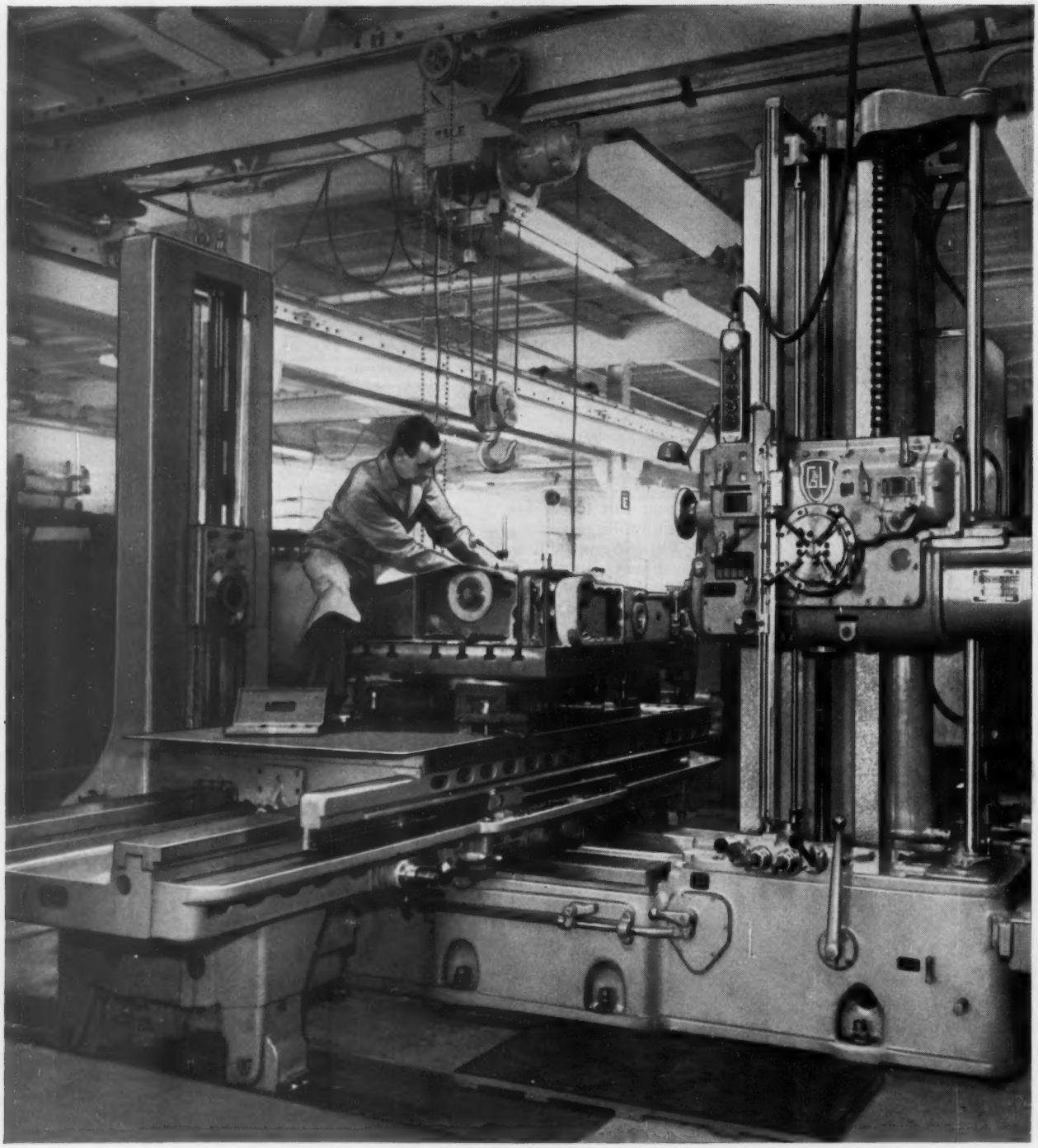
Company.....

Address.....

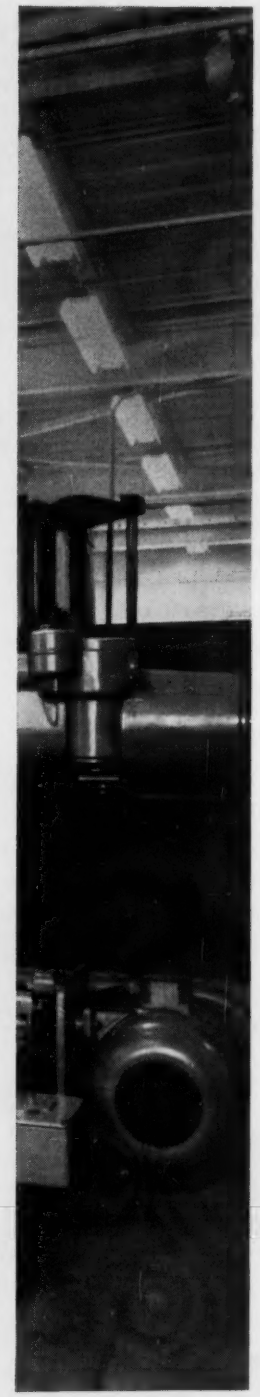
City.....Zone.....State.....

Stacy Machine Works Inc. reports:

"This machine is the



pride of our shop"



Here's production without rejects . . . precision boring within .0005" . . . and alignment and squareness to .001" . . . all accomplished on a G&L Model 340-T Table Type Horizontal Boring, Drilling and Milling machine with an Automatic Electric Positioning Device

Here's what a company executive of Stacy Machine Works, Inc., Agawam, Mass. said about their Giddings & Lewis Model 340-T Horizontal Boring, Drilling and Milling machine: "This machine is the pride of our shop. We're more than pleased with it. Its services are always in great demand."

"Because the Model 340-T is so versatile, our machinist can perform many complex, precision operations in a single setup . . . apply faster cutting speeds on heavy cuts and hold exact tolerances. One of the many workpieces we produce is this 40" x 50" cast aluminum Gimbal ring. Critical points in machining this casting are alignment of bores and squareness to .001" and bore diameters finished within .0005". What's more, the entire lot of 63 pieces were completed without a single rejection."

This Model 340-T is equipped with an extended saddle with saddle supports and an Automatic Electric Positioning Device. The accessory rotary indexing table is mounted on the machine table. With this combination the operator is able to materially reduce the time ordinarily required to set up and index the work. The Automatic Positioning Device automatically locates and controls the distances between machined holes.

If you, like Stacy Machine Works, Inc. face unusual machining and production problems, call in your G&L representative. He'll be glad to help you solve them.

LITERATURE AVAILABLE:
Ask for Catalog No. 30-T with details on 30 Series Precision Horizontal Boring, Drilling and Milling Machines

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools

Grinding Output per Wheel Tripled

The PROBLEM

271 Pieces With Previous Wheel

The cylinder wheel previously used on a rotary table surface grinder had to be replaced after grinding only 271 pieces. The work handled on this grinder ranges from malleable castings to steel weldments, covers, castings and forgings.

The SOLUTION

836 Pieces With New Gardner Wheel

The Gardner Abrasive Specialist recommended a YELLOW-RIM WIRE-LOKT® cylinder wheel with 2¾" face. The Gardner wheel ground 836 pieces before replacement, three times the life of the former wheel.

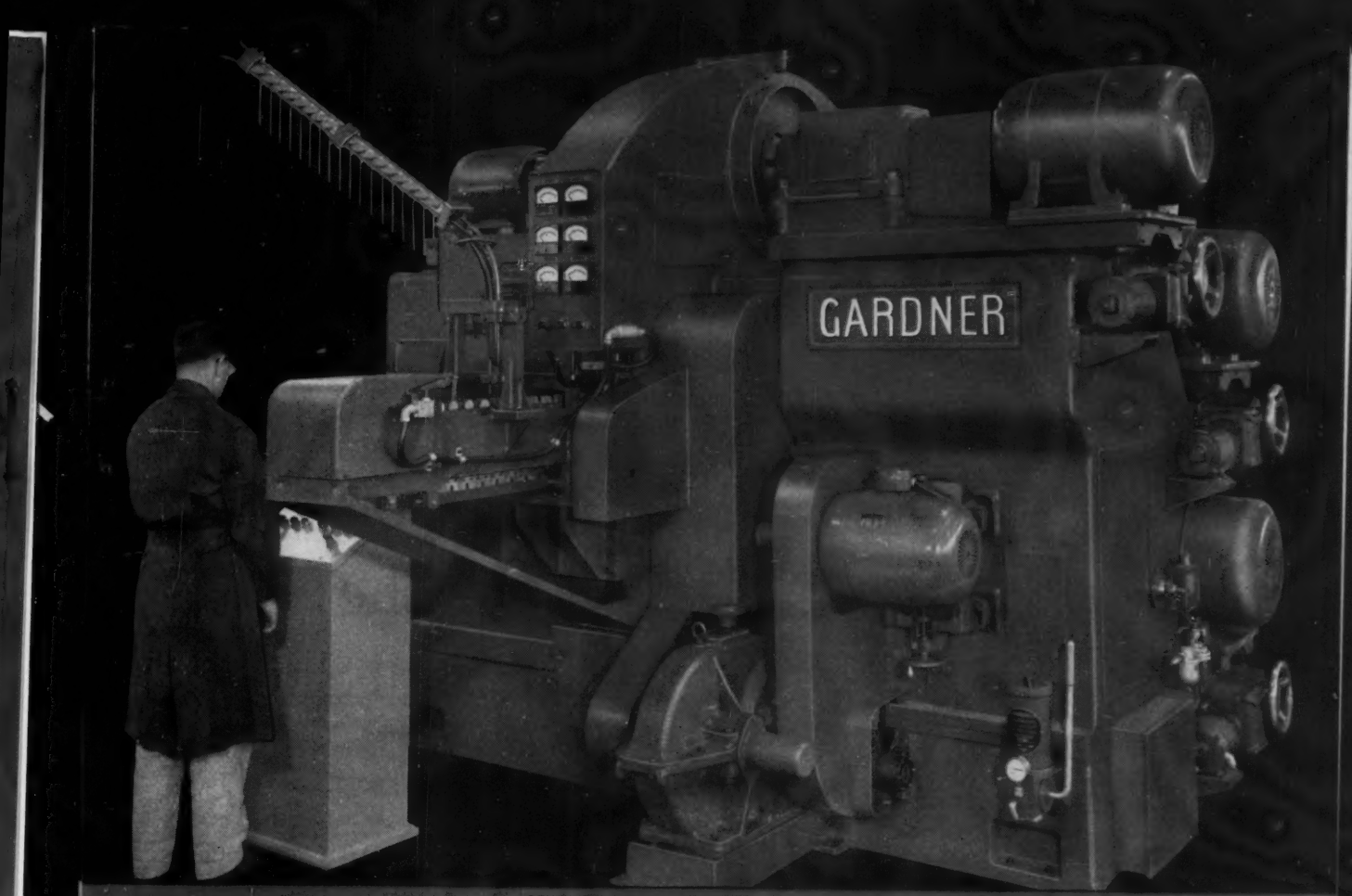
See the Gardner Abrasive Specialist for solutions to your flat surface grinding problems. He offers you valuable help because he knows both abrasives and machines.

124A

GARDNER

abrasive discs

BELOIT, WISCONSIN, U.S.A.



GARDNER AUTOMATION grinds a valve every 2 seconds

Job Data

MACHINE Gardner No. 178-A Six-Head Grinder.

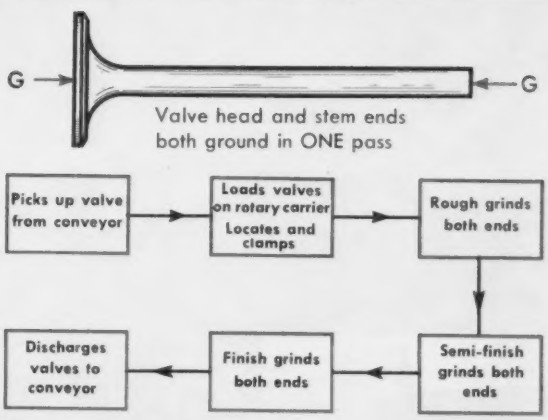
TOOLING Transfer conveyor automatically loads valves, an endless work-holding conveyor with vee-notched metal links and automatic clamping.

PART Automotive valve; alloy steel forging.

STOCK REMOVAL Approx. .070" overall.

TOLERANCES .0003" for squareness and .002" for uniformity on stem end.

ABRASIVES Gardner Yellow Rim WIRE-LOKT® Discs—three 23" discs on head end, three 18" discs on stem end.

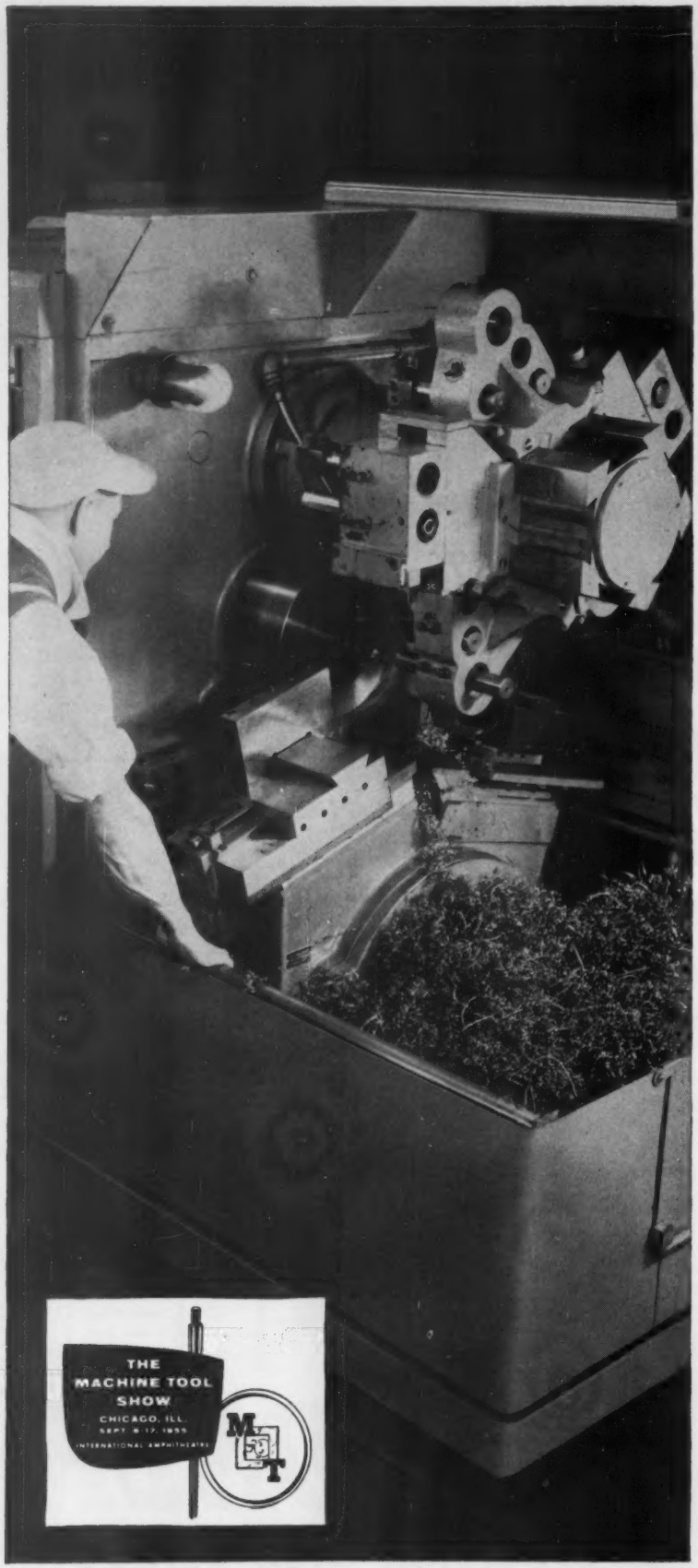

G
G
Valve head and stem ends both ground in ONE pass
Picks up valve from conveyor
Loads valves on rotary carrier
Locates and clamps
Rough grinds both ends
Semi-finish grinds both ends
Finish grinds both ends
Discharges valves to conveyor

GARDNER

precision disc grinders

BELOIT, WISCONSIN, U.S.A.

140M



Do Automatics Pay off for the Small Shop?

SKIDMORE-WILHELM Manufacturing Company, a 23-man job shop, will give you an enthusiastic "yes" to this question! And they can give you dollars and cents *proof* of their answer!

This progressive 11-year-old Cleveland company installed a Warner & Swasey 1 AC Single Spindle Automatic 3 years ago to speed up some of the turret lathe work on the many different jobs they turn out. They have since added one more 1 AC and one 2 AC.

Increase Capacity

With these Automatics they have been able to increase their capacity in the existing plant, speed up work, and cut costs. These cost savings, passed along to customers, mean lower quotations on jobs—which just naturally means more jobs coming into the Skidmore-Wilhelm shop, more profits.

YOU CAN PRODUCE IT

Small Lots Profitable

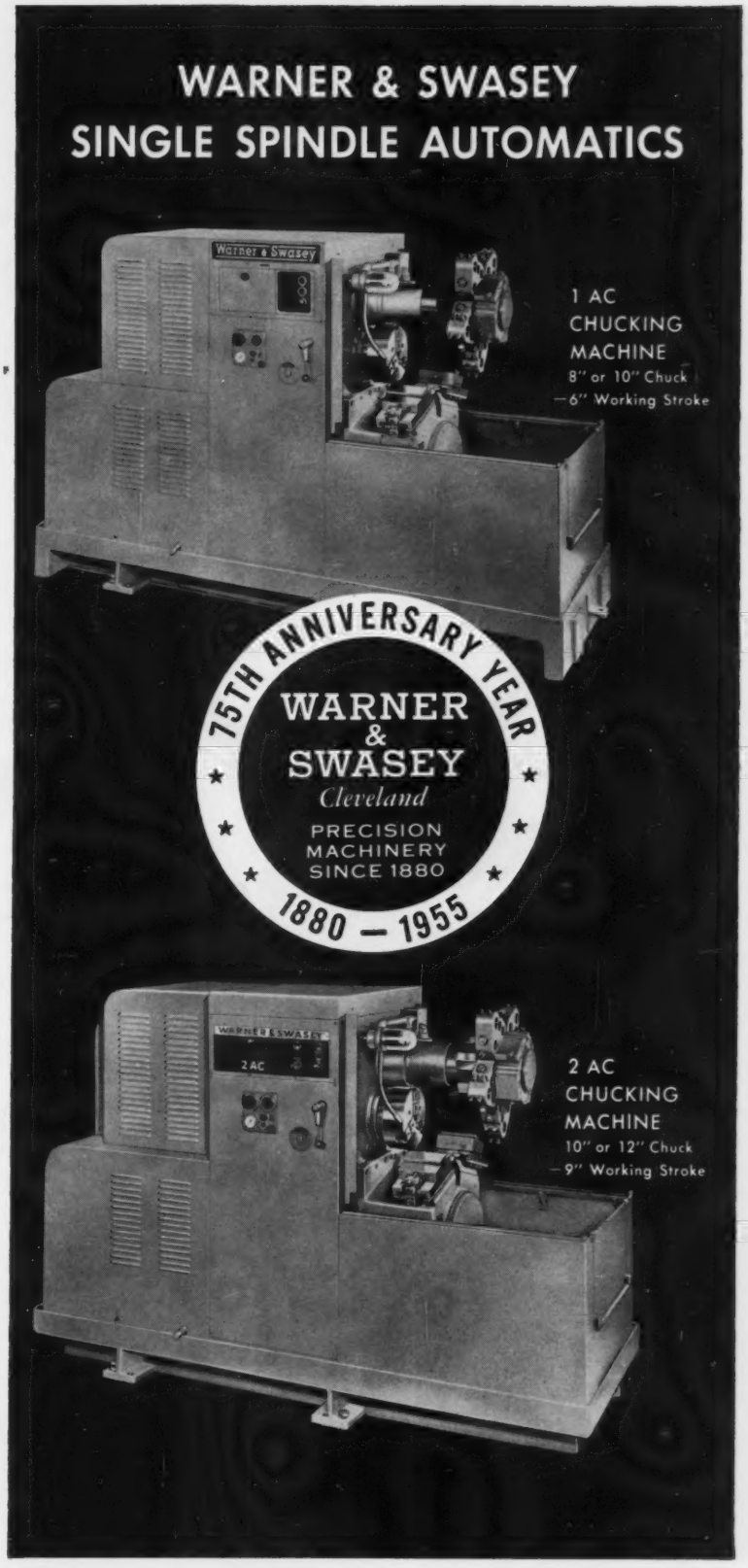
In the face of traditional stiff job shop competition, this company has found that these Warner & Swasey Automatics are profitable on runs as small as 100—sometimes even smaller, depending on the complexity of the operations involved. As a recent promotion folder states about their use of the Automatics, "We use lots of multiple cuts." And, of course, on longer runs the machines' automatic operations pay off even more!

Speed Operations

As a rule one man operates two of the Automatics while the second operator sets up the third machine. Setup time averages about 2½ times that of a turret lathe, but as R. H. Skidmore, Chief Engineer, says, "The Automatics more than make up for it in their faster running time. They're just more profitable all the way around, even when you have to figure in amortization of their higher cost".

Most jobs here can be run in 60 to 70% of turret lathe time. J. W. Wilhelm, General Manager in Charge of Sales, commented on work speed-up this way, "Since we bought these Automatics, our cut-off saw can't keep up with production. And this never happened before".

But regardless of the size of your shop, an analysis of your work will undoubtedly prove that many of your present turret lathe jobs can be handled more efficiently, more profitably on a Warner & Swasey Single Spindle Automatic. Call in your *turning specialist*—your Warner & Swasey Field Representative—let him show you how an Automatic can improve your operations and boost profits!



BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

you can drive to the poorhouse

This is not intended as a joke: the machine tool that was ▸ *paid for* long since may today produce an annual loss equal to its cost of replacement. We know, because Avey equipment has helped many companies to stop losing money on antiques, and make money so fast that the investment was paid for in a year or year and a half. Why?

Because Avey production drilling machines are essentially simple, compact, straightforward in design, built in standard units that fit together to fit your job, and function with standard work-holding fixtures. When a production run is finished, the units are often rearranged for another job, at a fraction of the cost of the original setup, and the owner gets an even bigger bonus of earnings.

Are you really convinced that your drilling operations are now running at top efficiency? Send us your part prints and if we can't be convinced, too, *you stand to gain.* ◂

This Avey machine mills 88 slots in a stainless steel jet engine part—a slot every 40 seconds. Vertically mounted automatic cam feed unit produces desired cycle time. Cutter head can't operate unless automatic indexing table is in correct position. Our advanced Electrodex table makes it easy to change fixture and part quickly with only slight change in indexing mechanism.

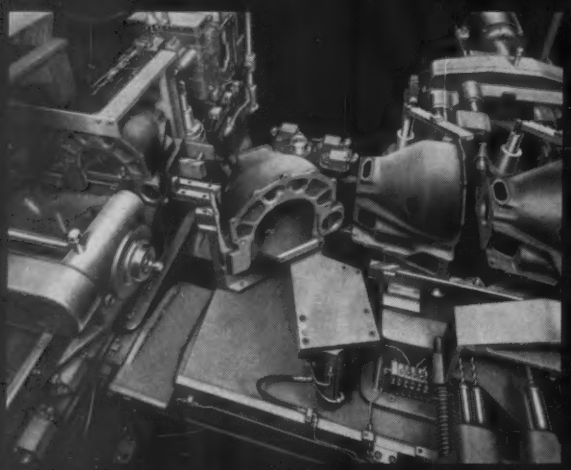
THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

...in a car that's paid for

Avey

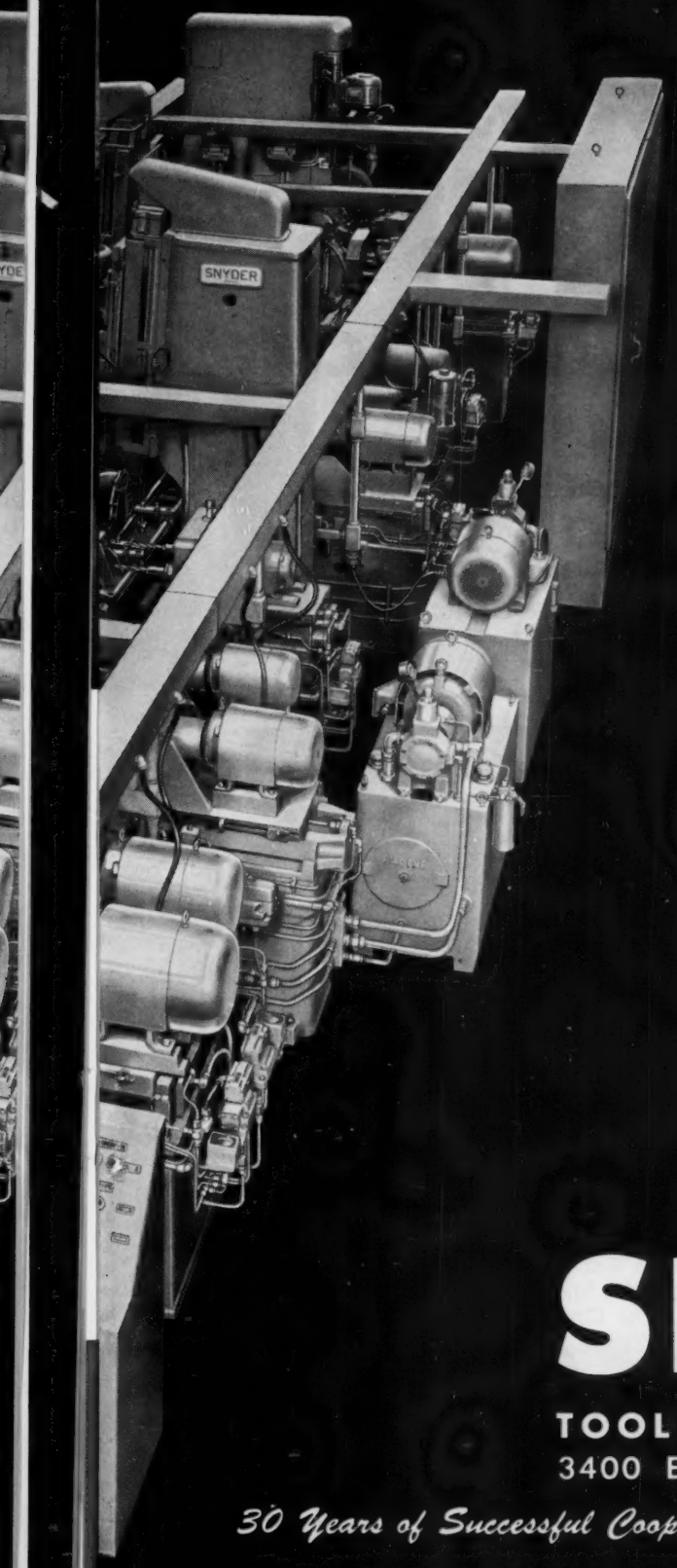
drilling, tapping, production machines

SNYDER—AUTOMATION



At Station 16, work piece is turned 90° and transferred to other rails without vibration or loss of precision locating.

LEADER FOR 30 YEARS



Presents

SNYDER SPECIAL

22-STATION automatic transfer machine for processing cast iron clutch housings; which drills, rough and finish bores, mills, saws, taps, spot-faces, counterbores and chamfers, performing a total of 110 operations on various surfaces or holes of various dimensions. Production, 124 cycles an hour at 80% efficiency.

UNUSUAL FEATURES: At Station 1, a 2" breather hole is trepanned from solid metal and finish bored with one tool. At Stations 8 and 9, a section of transfer rails cam-linked to milling units, drops to bring work piece into line with cutters. At Station 16, work piece is turned 90° and transferred to other rails without vibration or loss of precision locating.

SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE, DETROIT 7, MICHIGAN

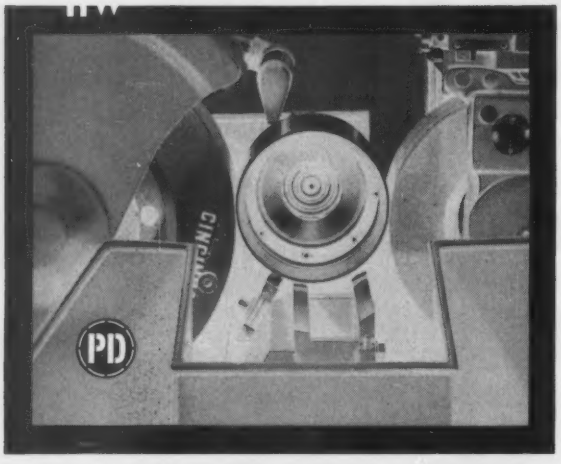
30 Years of Successful Cooperation with Leading American Industries

NOW!

Cincinnati Grinding Wheels offer

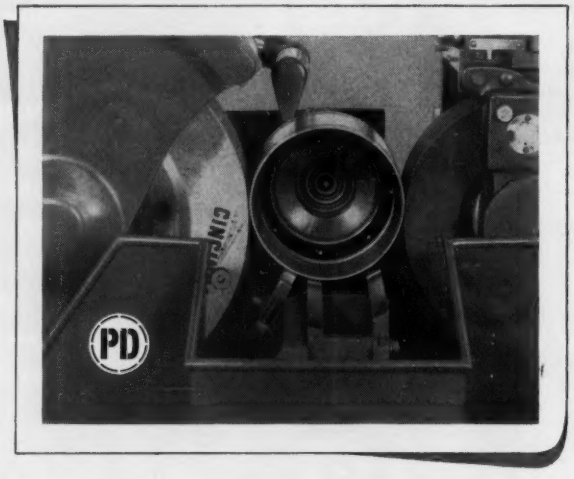
PD Positive Duplication

an outstanding development that will save you money and increase production



...POSITIVE DUPLICATION of an original grinding wheel each and every time through the CINCINNATI (PD) Manufacturing Process.

Just as a NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a...



Positive Duplication is the best news in years for everyone who uses grinding wheels. And small wonder that (PD) is such big news! For here is a truly remarkable achievement in precision manufacturing and quality control that *absolutely can save you money . . . and increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured a Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

We'll be glad to prove to you how CINCINNATI (PD) WHEELS can save you money and increase your production. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CINCINNATI *Grinding Wheels*

For more information on products advertised, use Inquiry Card, page 277

How to have 2 strings to your bow...

... SWITCH TO CIMCOOL°, the radically new and different coolant that has become, in a few years, the largest selling chemical-lubricant cutting fluid in the world. Here are two big advantages of CIMCOOL Standard Concentrate over old-fashioned cutting fluids:

CIMCOOL DOES A BETTER JOB because of its chemical lubricity. It permits faster speeds and increases tool life, for it combines friction reduction and cooling capacity in a degree never before attained.

CIMCOOL LOWERS COSTS because it lasts longer in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.

For information on the many specific advantages of CIMCOOL Standard Concentrate—or details on the entire family of CIMCOOL Cutting Fluids—just contact us. We'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

- CIMCOOL **Standard Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs.
- CIMCOOL **S-2 Concentrate**— For heavy duty use.
- CIMCOOL **Water Conditioner**—For increased rust control.
- CIMCOOL **Tapping Compound**—Increases tap life amazingly.
- CIMCOOL **Transparent Grinding Fluid**—Superior rust control at high dilutions.
- CIMCUT **Base Additive**—For jobs requiring an oil-base coolant.
- CIMCOOL **"CI"**—The cutting fluid for cast iron with exceptional rust control properties.
- CIMCOOL **Machine Cleaner**—The 2-phase non-corrosive cleaner that cuts grit, dirt, slime and oil.
- CIMCOOL **Bactericide**—The most effective agent yet developed to overcome rancidity.

CIMCOOL Cutting Fluids

100% for ~~85%~~ of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

Continuous Type Broaching Machine Built in Five Sizes

Holding Fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.

machining connecting rods and caps an opportunity for

Surface Broaching

■ Surface Broaching is a modern machining method that in many cases shows reduced costs through higher production, finish to closer tolerance, and low tool maintenance costs. If you machine large quantities of duplicate parts we will be glad to work with you on the possibility of adopting Footburt Surface Broaching Machines. Send us blueprints and hourly production requirements for our recommendations.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

FOOTBURT

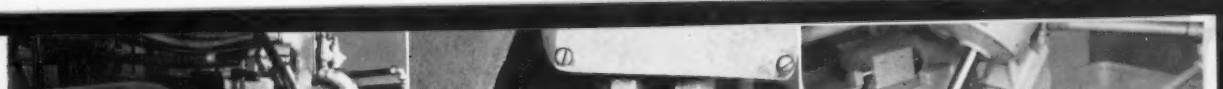
PIONEERS IN SURFACE BROACHING

For more information on products advertised, use Inquiry Card, page 277

PUZZLED?

...about the problems of machine tool replacement?

IF SO...



GREATER
SAVINGS

FINEST
MACHINES

EASIEST
PROCUREMENT

JONES & LAMSON

offers you

THIS COMBINATION

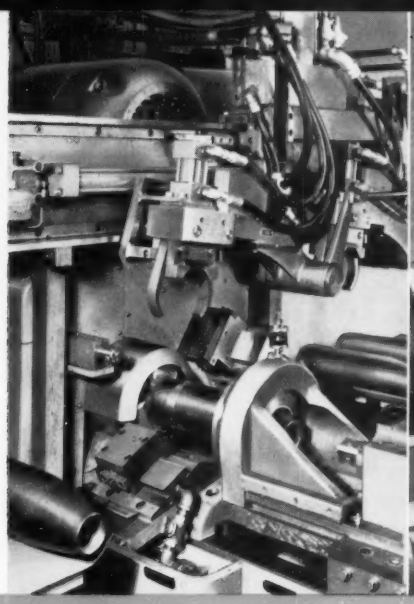
Modern machine tools that produce greater work accuracy at lower costs than ever before.

Scientific research in machining methods, metallurgy, tool geometry and inspection procedures.

Realistic Procurement — you have your choice of several sound financing methods, plus the advantages of new tax laws with more equitable write-offs.

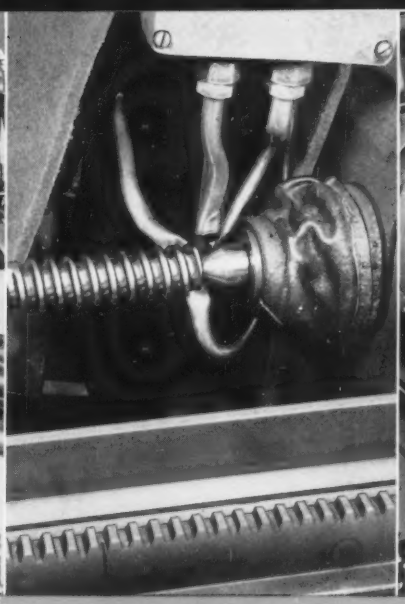
From initial survey of your production requirements right through to delivery and installation of new equipment, every phase of J&L's Replacement Program service is complete, competent and reliable.

The man who needs a machine tool . . . is already paying for it.



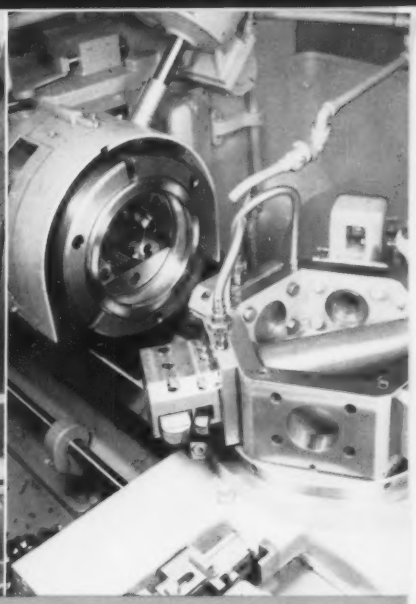
AUTOMATIC HANDLING

Completely automatic operation of this Fay Automatic lathe, including *loading*, *machining*, *chip and coolant disposal* and *unloading*, ups production to 180 pcs. per hour at 100% efficiency in the machining of these shells.



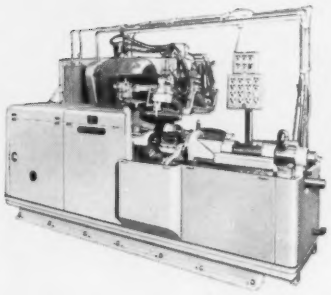
NEW METHODS

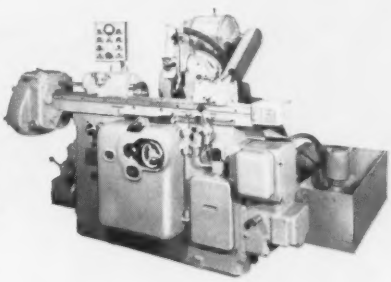
By grinding this worm (stock removal .1235″ — one pass) on a J&L 6 x 36″ Automatic Thread Grinder, production is increased 160% per machine over previous methods.

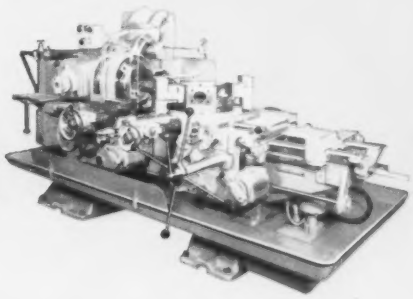


VERSATILE TOOLING

High production methods of tooling for automatic lathes were simplified and applied to three 7B J&L Universal Turret Lathes. Inner and outer Ball Bearing Races are produced on the same machines. Set up time from one lot to the next does not exceed fifteen to twenty minutes per machine.





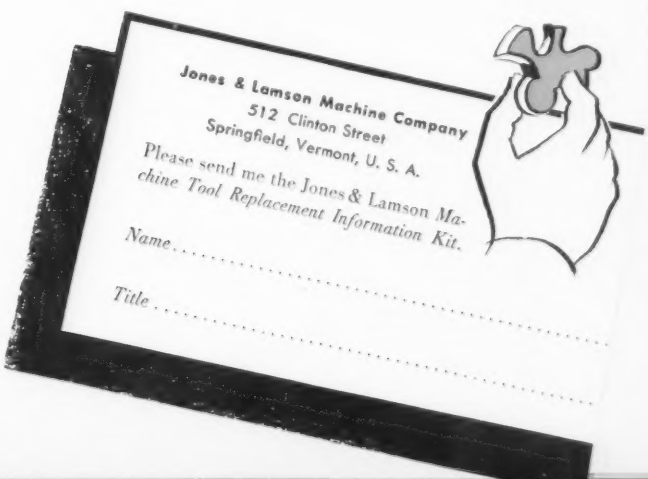


Jones & Lamson's unique Procurement Plan offers you a choice of methods for procuring new, high-efficiency equipment. You may buy outright; pay-from-productivity on a variety of bases, at interest rates of 3¼% and lower (add-on); or you may use any of several variations of a truly flexible lease plan.

JONES & LAMSON MACHINE CO.,
512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

Universal Turret Lathes • Fay Automatic Lathes • Automatic Thread & Form Grinders
Optical Comparators • Automatic Opening Threading Dies & Chasers
Automatic Double-End Milling & Centering Machines

Valuable information is yours for the asking. Simply fill in the coupon below, *clip it to your letterhead*, and mail.


Jones & Lamson Machine Company
512 Clinton Street
Springfield, Vermont, U. S. A.
Please send me the Jones & Lamson Machine Tool Replacement Information Kit.
Name
Title

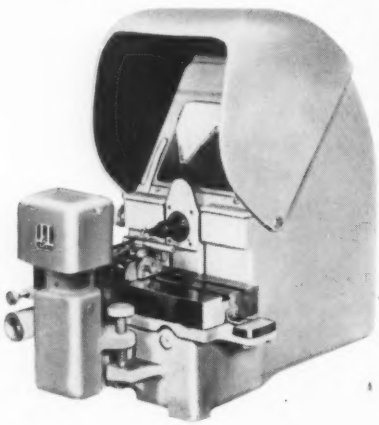
HOW TO "GUARANTEE A GUARANTEE"

Every set of Jones & Lamson Die Head chasers carries this full guarantee: *to produce Class III threads, or better, across the board.* To insure this guarantee, and to keep manufacturing costs down, J&L carries on successive interoperation inspections the positive way, with Jones & Lamson Optical Comparators.

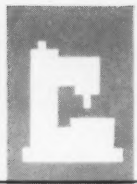
(We practice what we preach)

Avoid costly work on scrap—
Prove machining results before subsequent operations

Controlled quality means lower costs. Use J&L Comparators on *your* production line . . . their versatility is unlimited.



Write Dept. 710 for information on Comparators and/or Jones & Lamson Thread Tool Products.

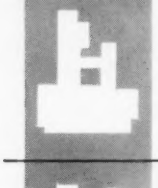


Dovetails of chasers are straddle milled. Tolerances checked on

The J&L OPTICAL COMPARATOR

Mill angle on front end of chaser. Length and angle checked on

The J&L OPTICAL COMPARATOR



Dovetail angle milled. Angle and centerline checked on

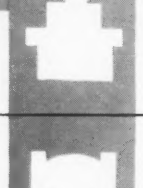
The J&L OPTICAL COMPARATOR

Ratchets for spacing are milled. Chaser length, ratchet form and spacing checked on

The J&L OPTICAL COMPARATOR

Back chamfer is milled. Angle and flat checked on

The J&L OPTICAL COMPARATOR

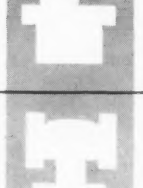


After heat treating, dovetail is ground. Angles, flats and depth inspected on

The J&L OPTICAL COMPARATOR

Grind thread form. Thread form, angles, root, crests, spacing, lead and helix checked on

The J&L OPTICAL COMPARATOR



Chamfer ground as specified. Angle and amount below root checked on

The J&L OPTICAL COMPARATOR

Top rake ground. End grind and point height checked on

The J&L OPTICAL COMPARATOR

JONES & LAMSON

World's largest manufacturer of Optical Comparators since 1919

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.

PRODUCTION *Zooms* 1000 PER CENT

with

Mechanized HELIARC Welding

A HELIARC HW-13 torch is being used to weld a 1/8-in. aluminum radar cover.

A West Coast aircraft plant is using mechanized HELIARC welding to join the components of aluminum sealing covers for radar units—the "Seeing Eyes" of the Armed Services. Welding time has been cut from one hour and 10 minutes to only six minutes and the plant now turns out eleven covers in the same time it had formerly taken to produce one. Because the HELIARC welds are shielded from contamination by an inert gas, such as argon, they require no flux and are free from porosity and oxide inclusion. This results in fewer rejections and a minimum of finishing.

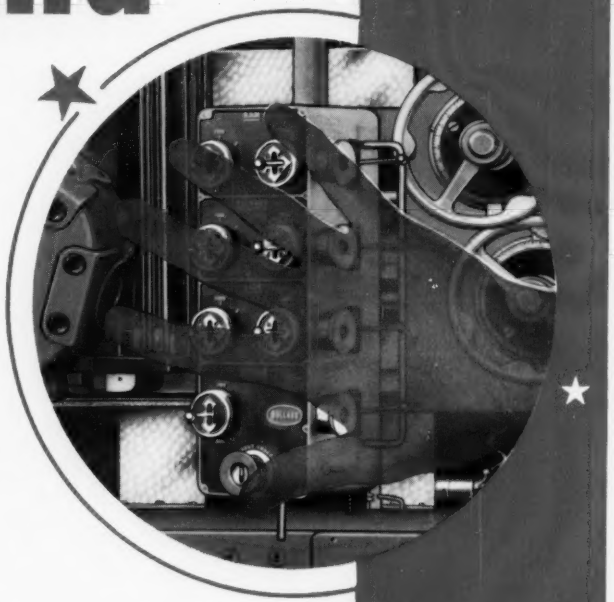
LINDE's team of welding processes—HELIARC, sigma, and UNIONMELT welding—can help you cut production costs and increase quality. Whatever your welding problem—one of LINDE's electric welding processes can do the job efficiently and economically. Call your local LINDE representative today for more information.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

"Heliarc," "Unionmelt" and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation.

Linde
Trade-Mark

Within the Span of a Man's Hand



The power to transmit the commands of the operator to the machine...

By means of the movable PENDANT CONTROL the start and stop of the spindle; selection of speeds, feeds and directional movements of all heads in feed or traverse are quickly and easily accomplished. Interlocks and a stopall stick provide safety for both operator and machine.

Additional features include:

SCREW FEED

for vertical and horizontal motion of all heads—to assure fine smooth finishes with greater accuracy.

POWER INDEXED MAIN TURRET (optional)

Five sided turret for "run of the mill" jobs. Four sided turret for production jobs.

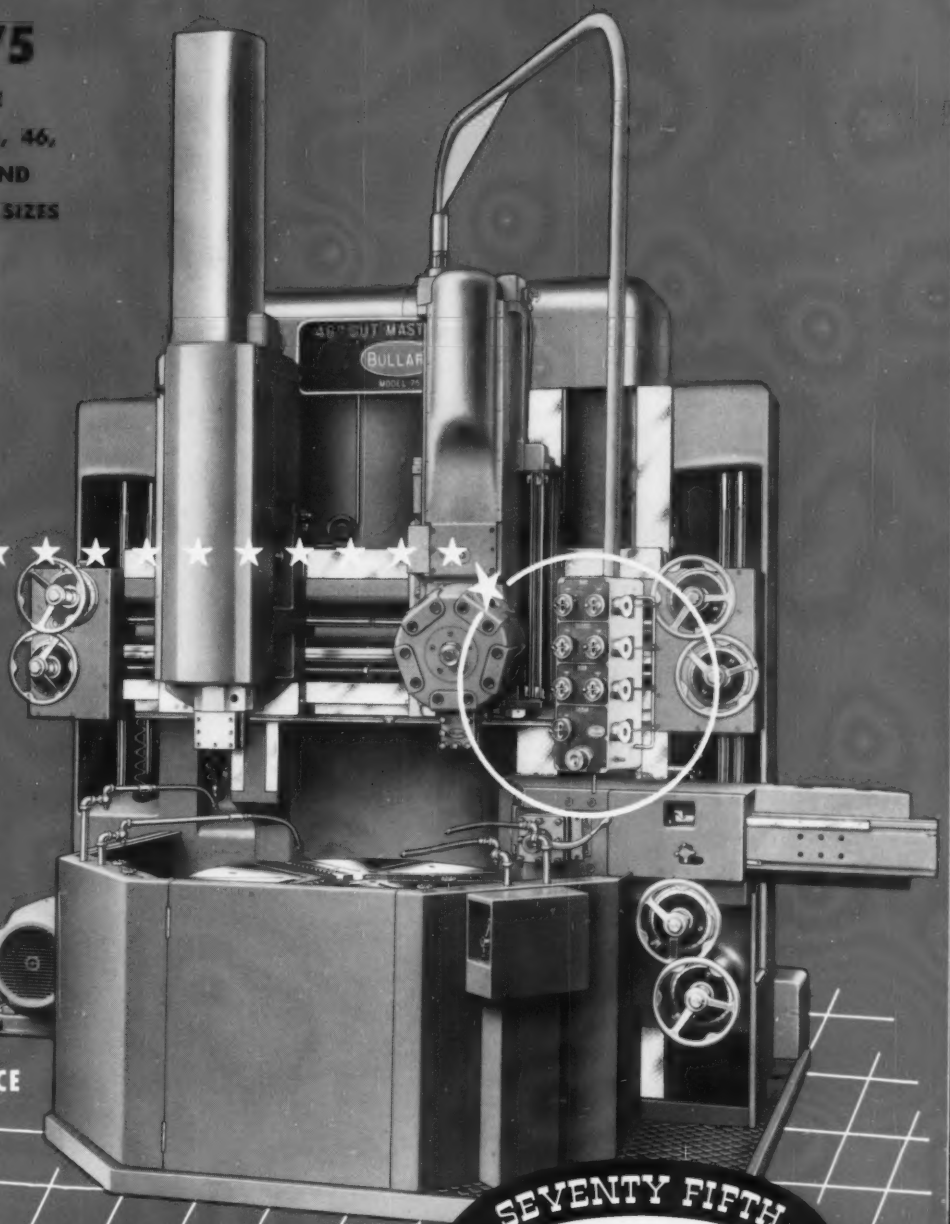
PLAN TO VISIT

OUR EXHIBIT AT BOOTH 1213

CUT MASTER
VERTICAL TURRET LATHE

Model 75

AVAILABLE
IN 26, 36, 46,
56, 66, AND
76, INCH SIZES



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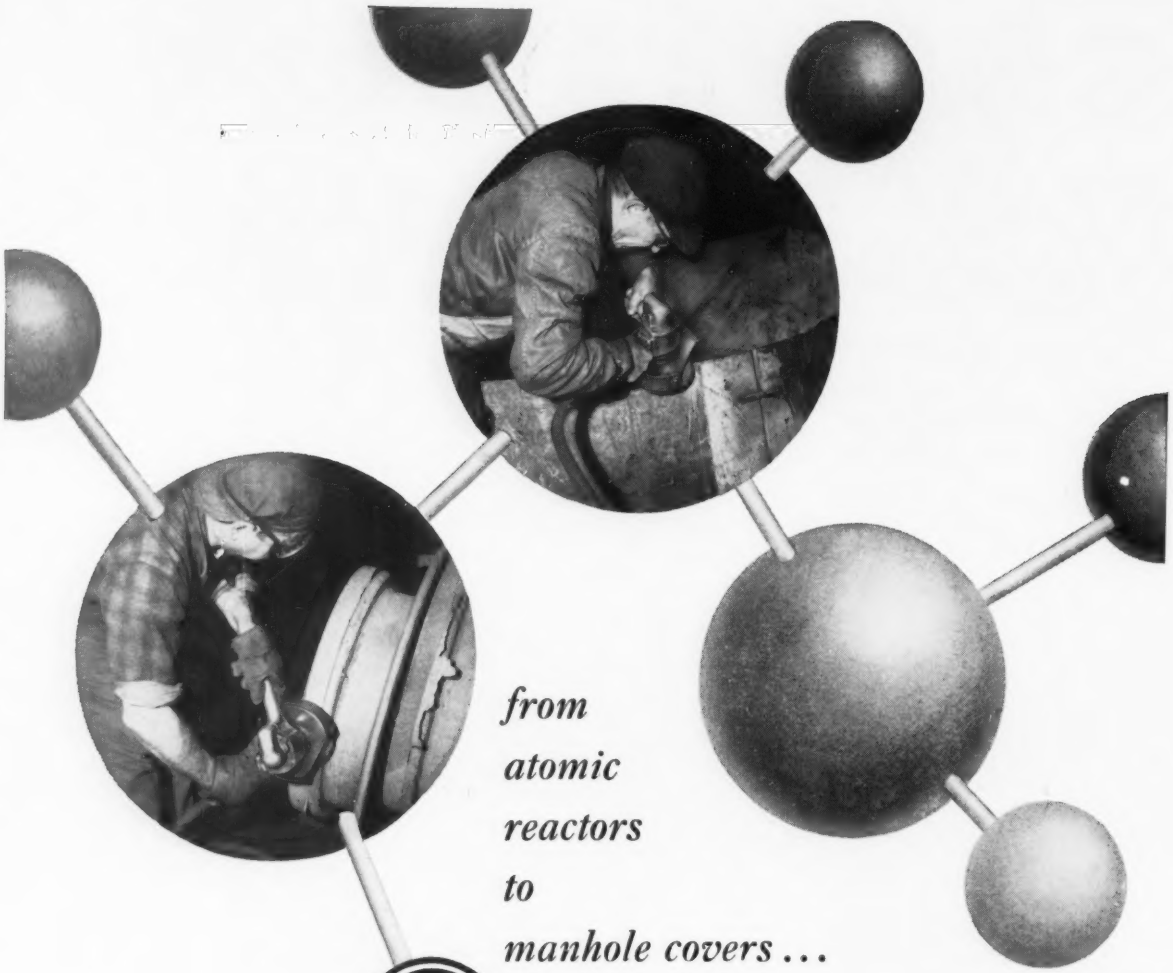

from atomic reactors to manhole covers . . .

7 pound CP grinder grinds them all!

Here's a grinder that can't be beat for handling ease and versatility. It's the 7 lb. air powered CP-3190 Vertical Grinder. Whatever the job . . . whether it's precision contour grinding for joining components of an atomic reactor or the heavy duty snagging of grey iron from manhole cover castings, the compact CP-3190 affords maximum removal of metal with the least amount of effort.

Designed for long life and an absolute minimum of maintenance, the CP-3190 has a splined type floating rotor that prevents end-plate wear from wheel thrust. A large oil reservoir and self-lubricator provide continuous lubrication. Available in capacities capable of handling 6″ cup wheels and 7″ and 9″ disc sanding pads and cut-off wheels and in speeds up to 8000 RPM.

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

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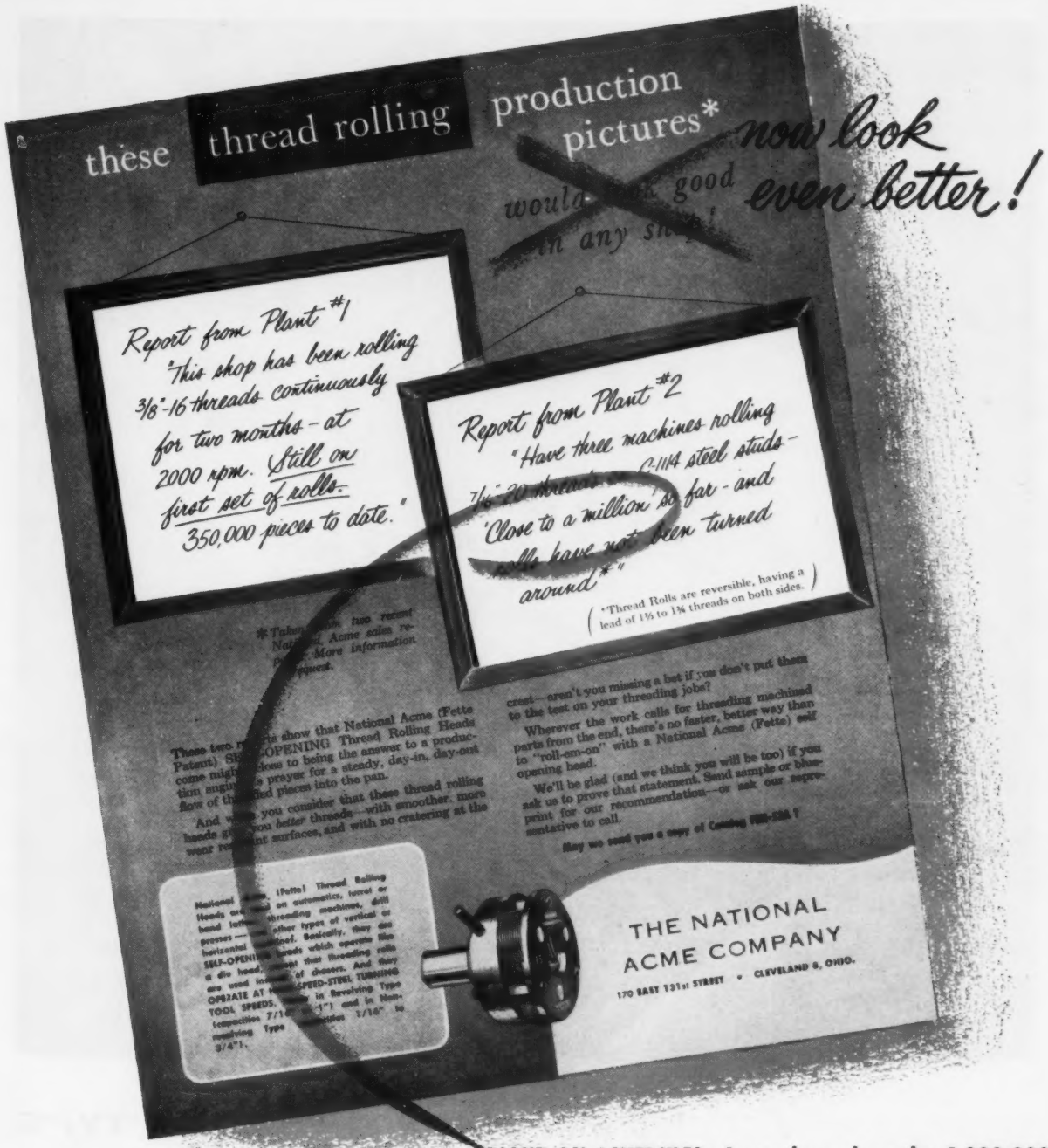
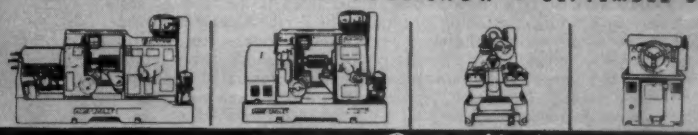
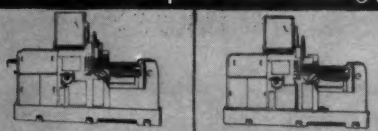

these thread rolling production pictures* now look even better!
Report from Plant #1
"This shop has been rolling 3/8"-16 threads continuously for two months – at 2000 rpm. Still on first set of rolls. 350,000 pieces to date."
Report from Plant #2
"Have three machines rolling 7/16"-20 threads on C-1144 steel studs – 'Close to a million' so far – and rolls have not been turned around*"
(*Thread Rolls are reversible, having a lead of 1½ to 1¾ threads on both sides.)
THE NATIONAL ACME COMPANY
170 EAST 131st STREET • CLEVELAND 8, OHIO.

***RIGHT ON SCHEDULE!** 4 months and another 1,000,000 pieces later, the original set of rolls are still on the job. Have you taken a close look at your threading picture lately?*

SEE US AT THE MACHINE TOOL SHOW • SEPTEMBER 6 TO 17 • BOOTH NUMBERS 324 AND 708



OUR JOB: to provide the *Right Machine* for **YOUR JOB**



Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

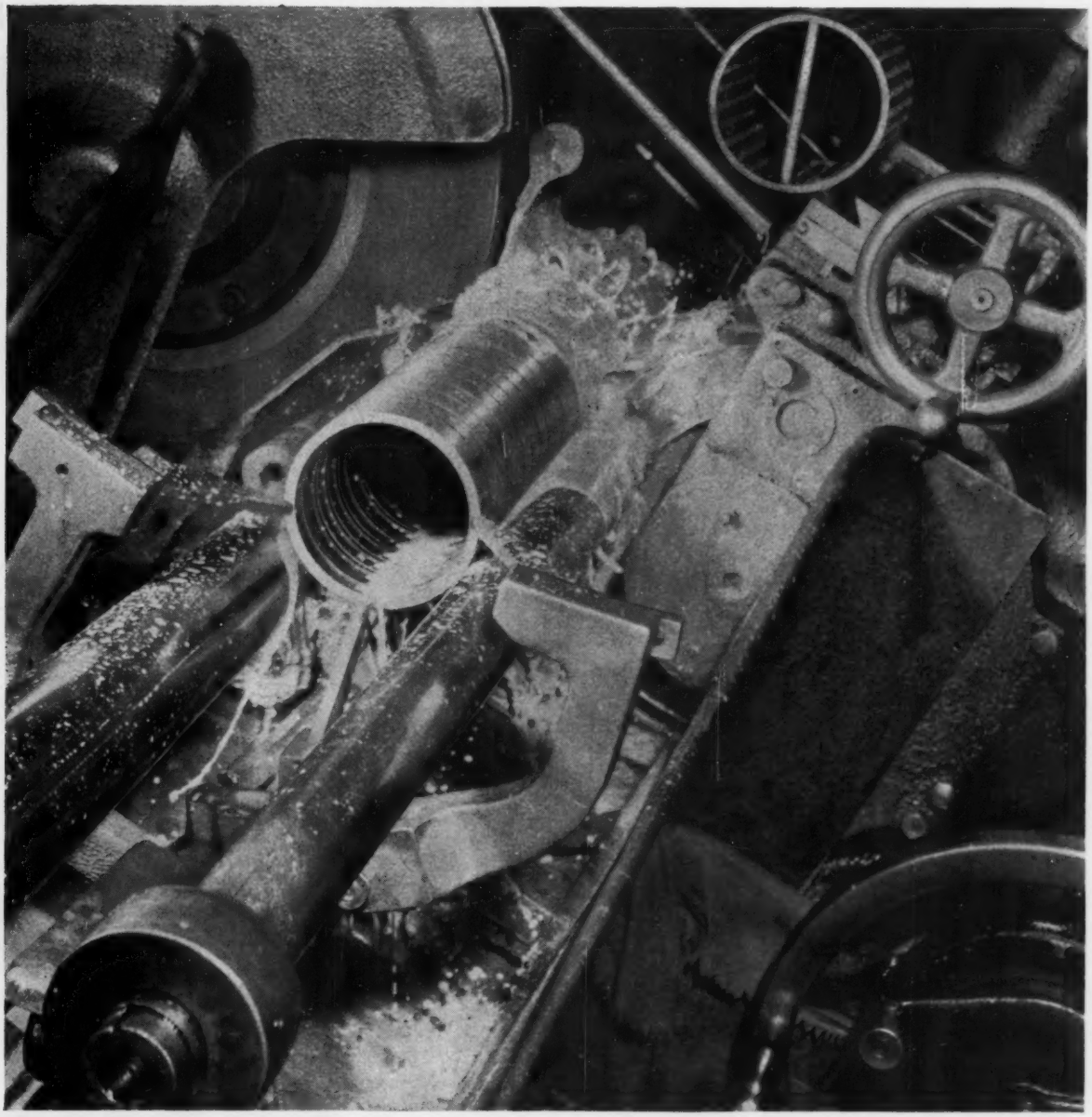
THE NATIONAL ACME COMPANY

179 EAST 131st STREET • CLEVELAND 8, OHIO

For precision grinding... **CENTER TYPE**

YOUR CARBORUNDUM DISTRIBUTOR or Salesman is the man to see—now! For each of your cylindrical grinding operations, he'll recommend the proper wheel by CARBORUNDUM to give you the exact results you're looking for. Call him today—he's listed in the yellow pages of your phone book under "Abrasives" or "Grinding Wheels." His impartial recommendations based on years of experience, plus complete stocks and fast, dependable service, makes him the *one* man who can help you solve all your grinding problems.

FREE BULLETINS! Packed with helpful information on cylindrical grinding, both center type and centerless. Write The Carborundum Company, Dept. M 81-55, Niagara Falls, N. Y. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ont.



...or CENTERLESS

THE RIGHT WHEEL for every grinding operation can improve your quality, boost production... and cut your costs! To give you the exact combination of abrasive grain, grade, structure and bond, CARBORUNDUM puts years of research, engineering and testing into the development of every new grinding wheel—as much as you'll find behind any other precision machine tool in your shop.

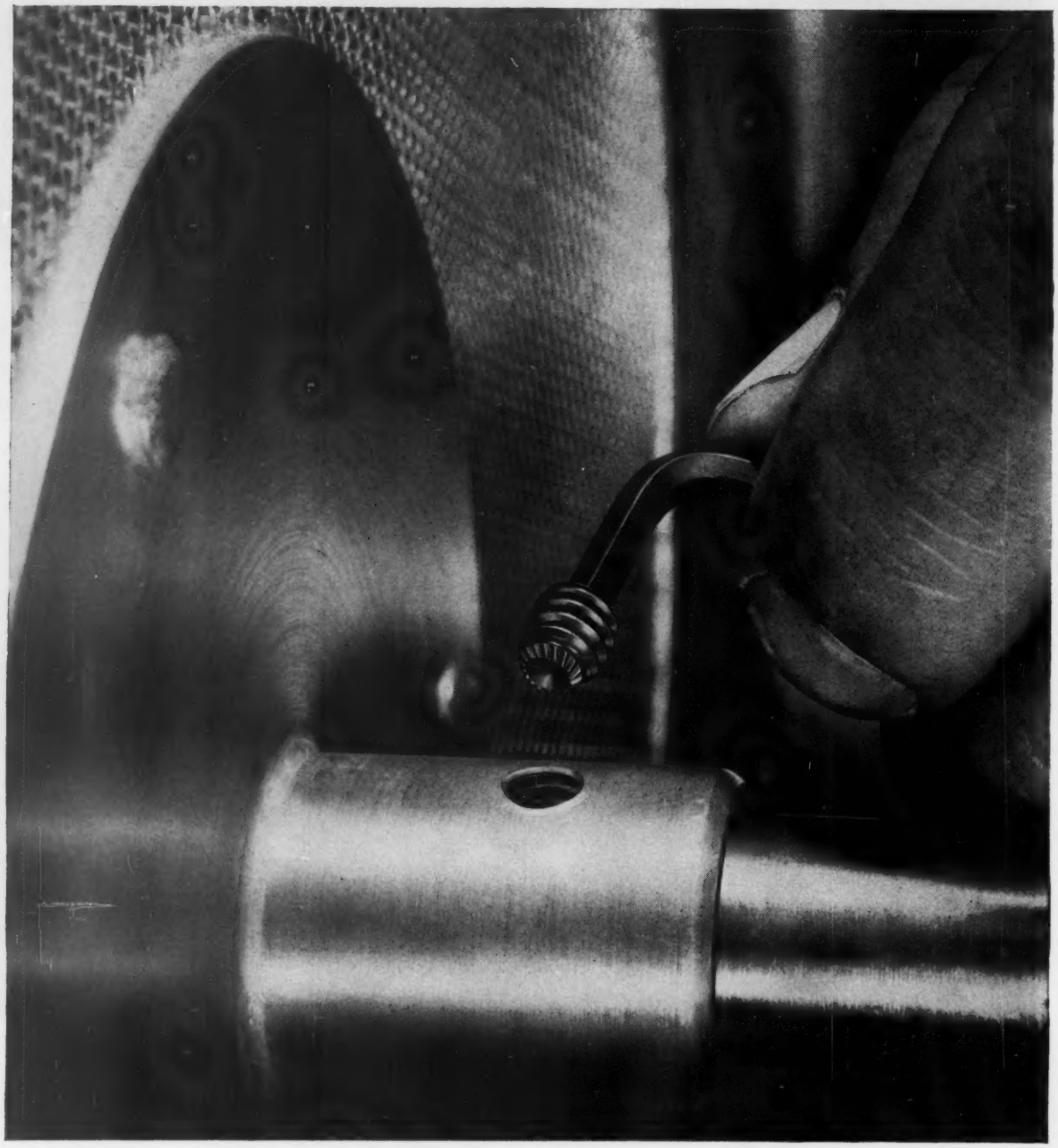
CARBORUNDUM

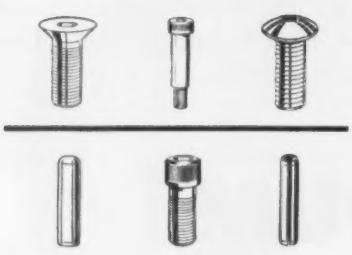
REGISTERED TRADE MARK

...continually putting more **SENSE** *in your abrasive* **DOLLAR**

81-55

UNBRAKO AT WORK





HOW TO KEEP A SET SCREW TIGHT. Tighten it as tight as possible. Keep it in place by preventing it from starting to work loose. With UNBRAKO Self-Locking Socket Set Screws you can do both. They are designed for the highest recommended tightening torques in the industry—as much as 45% higher than those used for ordinary socket set screws. UNBRAKOS have the unique knurled cup point which prevents them from starting to work loose, even in poorly tapped holes. For the complete UNBRAKO story, see your industrial distributor—or write STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

UNBRAKO SOCKET SCREW DIVISION SPS JENKINTOWN, PENNSYLVANIA

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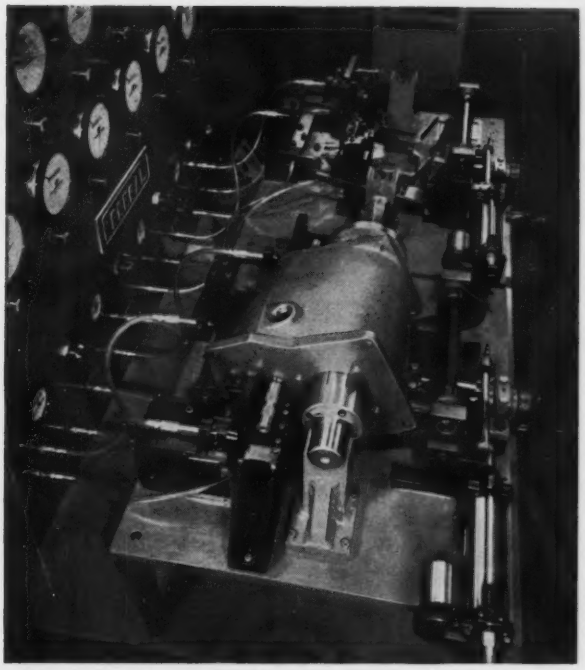
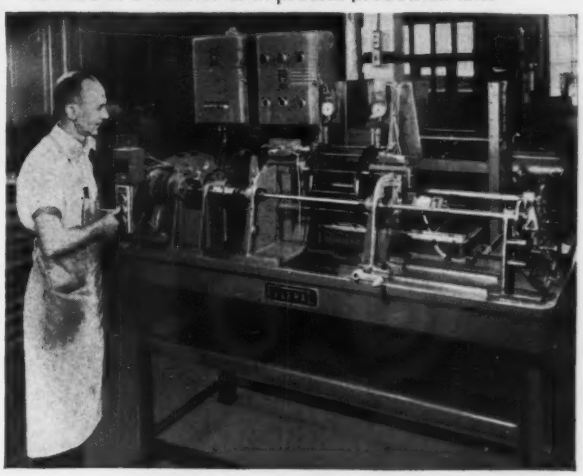
HOW FAR DO YOU WANT US TO GO WITH YOUR AUTOMATION?



We can furnish equipment to check any number of dimensions simultaneously by any basic gaging method — whichever is best suited to the job.

OR We can go the whole way to "Push Button" in-process control. Shown here is one of a group of gages installed in a transfer or in-process production line.



FEDERAL has a wealth of experience in meeting the requirements of modern Automation. From a most complete line of individual dimensional indicating gages to standardized package units for air, electrical, electronic or combination machine controls, we can provide any degree of Automation you desire. Our engineers will gladly cooperate in adapting these to your requirements.

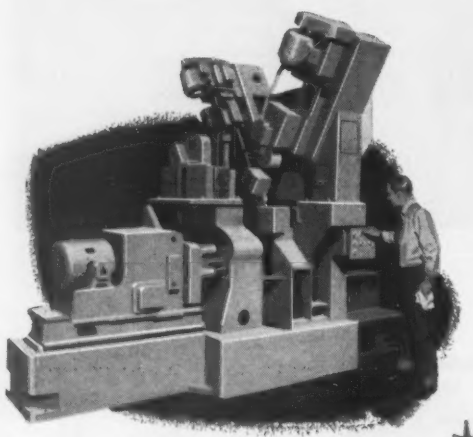
FEDERAL PRODUCTS CORPORATION
5116 Eddy Street • Providence 1, Rhode Island

Ask FEDERAL
FOR ANYTHING IN MODERN GAGES...

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automatically Controlling Dimensions on Machines

For exceptional service to industry, it's

DELCO preferred



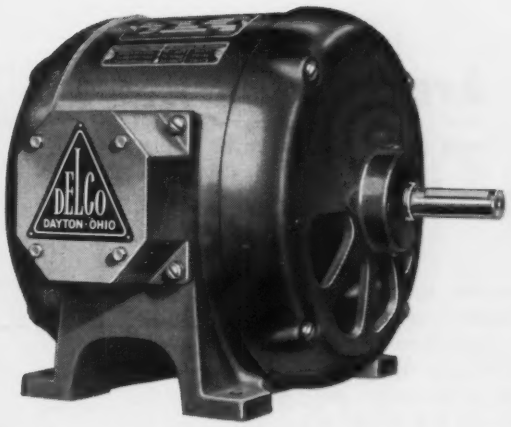
There is a Delco Electric Motor for almost every industrial need, from smallest integrals to big totally enclosed fan-cooled models.

Each Delco Electric Motor is built to rigid standards of quality, and subjected to rigorous tests throughout production.

And the noted Delco design engineering service "job fits" the right electric motor to your special industrial requirement—helps you specify the right motor for each application. Delco Products

★ *See Delco Electric Motor national advertising in The Saturday Evening Post for the story of the full Delco Electric Motor line.*

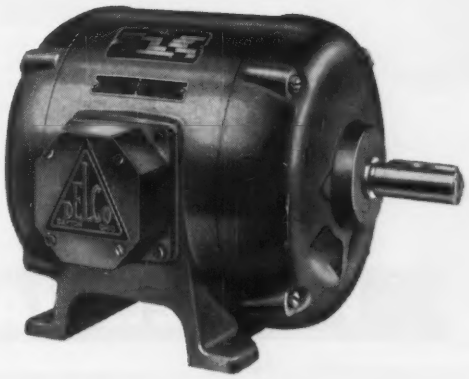
DELCO
DAYTON OHIO



engineers will work with your engineers to make certain it's right.

That's why Delco Electric Motors perform better, stand up longer, cost less to maintain. That's why in industry it's Delco Preferred . . . why Delco is best for you.

Wherever your plant is located, Delco parts and Delco service will always be available nearby. Your requests for further information will be most welcome, and will be given prompt attention.



GM GENERAL MOTORS DELCO

DELCO *Electric* MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS, DAYTON, OHIO

Proved best by Performance!

Are you BARRED

from planned assembly savings

BY A THREAD?

Screws can be "trouble-bent" in many ways. Most thread faults like those listed here are invisible, but their effects (job slowdown, parts spoilage, high reclamation expense, hidden weakness) show clearly in assembly costs and customer complaints.

That's why P-K quality standards have been set so high—to make sure you get Self-tapping Screws that are not only threaded, but headed, pointed and heat-treated with one purpose in mind, to keep your assembly lines trouble-free.

For information on any fastening problem, talk to a P-K Assembly Engineer. Parker-Kalon Division, General American Transportation Corporation, 202 Varick St., New York 14. Chicago Warehouse, 4331 West Lake St., Chicago 24.

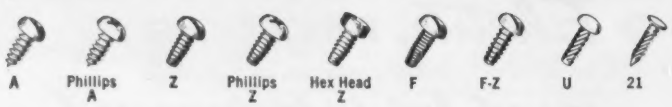
IS DIAMETER OFF-SIZE?
— means hard driving
— breakage
— weak fastenings
DO THREADS STOP SHORT OF HEAD?
— means loose screws
ARE THREADS RAGGED and SEAMED?
— makes driving difficult
ARE THREADS TOO SOFT?
— means spalled threads
ARE THREADS TOO HARD?
— means stripped threads
IS POINT (on Sheet Metal Screws) BLUNT?
— makes starting difficult

P-K STANDARDS PROTECT you against the thread faults illustrated and many others that will cause assembly trouble and weak fastenings. They don't "get by" P-K inspectors—that's why *all* P-K Self-tapping Screws can be "Guaranteed First Quality."

EASTMAN KODAK speeds up assembly of the Kodalite Flashholder by using P-K Self-tapping Screws. Troublesome tapping of small holes in plastic was eliminated. Screws are driven with hopper-fed automatic machines, removing necessity for tedious screw handling and placement. Two P-K Phillips Head Type F Screws fasten a cover mounting bracket to the flashholder case (right) and three more fasten the metalized Tenite II reflector to the case (left). Case is a thermo-setting phenolic. Screws hold firmly under all stresses of normal use, can be removed for attachment of new reflector.

PARKER-KALON®

The First SELF-TAPPING SCREWS



IN STOCK . . . see your nearby P-K Distributor

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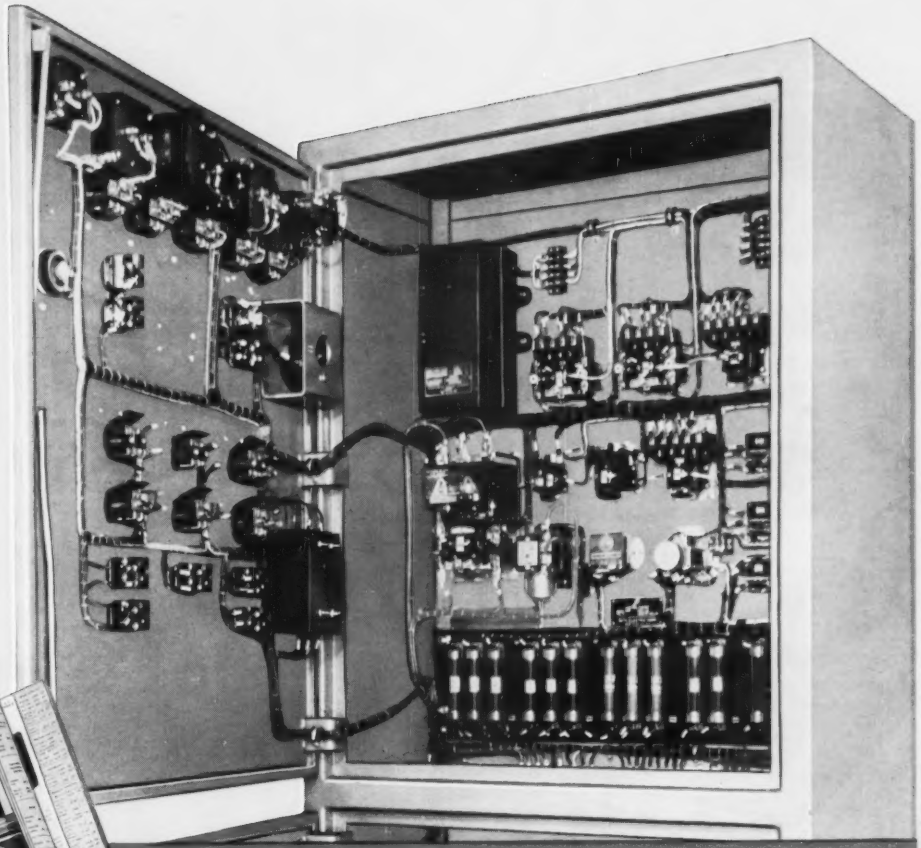
The Sign of
QUALITY
MOTOR CONTROL

Control panel for BETA dust precipitator rectifier, shown below with door closed. It has 3 Bulletin 709 starters, 2 Bulletin 700 relays, Bulletin 702 contactor, and Bulletin 809 overload relay. On door are 20 Bulletin 800T oiltight push buttons and pilot lights.



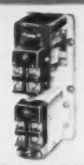
MANUAL and AUTOMATIC COMPONENTS for *Trouble Free* Control Panels

Automatic control panels must be reliable . . . not just MOST OF THE TIME but ALL OF THE TIME. The failure of only one component . . . JUST ONCE . . . may be costly in spoilage and production delay.

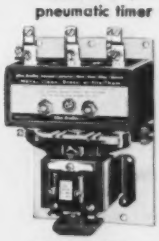
A-B controls continue in first place in dependable switching because they are so simple. They have no troublemaking pivots, pins, or bearings to gum up and stick. Their double break, silver alloy contacts never require maintenance until all contact material has been worn away.

Specify Allen-Bradley controls for your machines. Send for the A-B Handy Catalog.

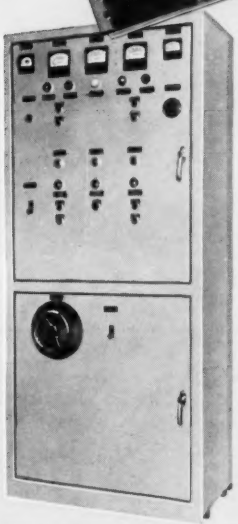
Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd.
Galt, Ont.



Bulletin 849
pneumatic timer



Bulletin 702
Size 2 contactor



BETA dust precipitator control cabinet with A-B oiltight push buttons

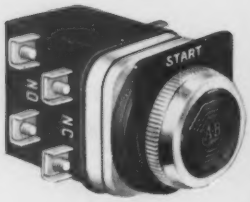
Bulletin 700
universal relay

Bulletin 609
manual starter

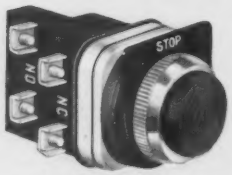
Bulletin 709
solenoid starter

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

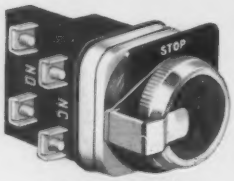
5-55-R



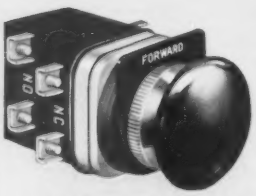
Start button



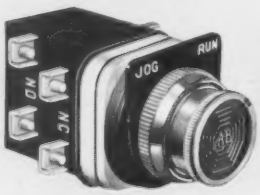
Stop button



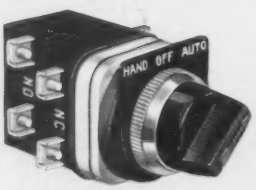
Stop button with locking attachment



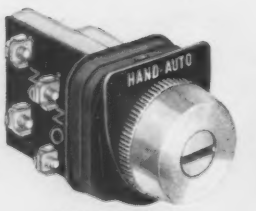
Mushroom head button



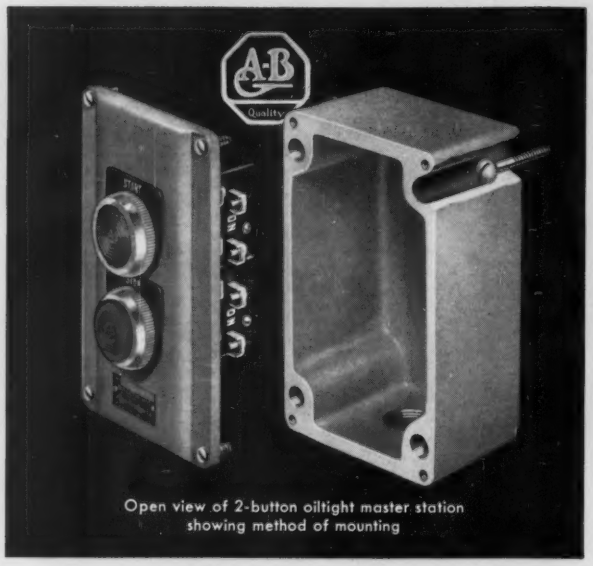
Jog button



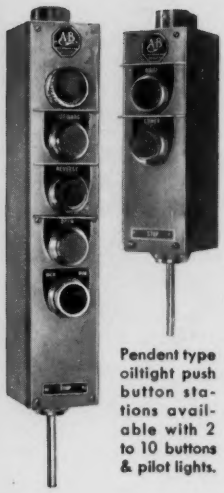
Selector switch



Coin slot selector



Open view of 2-button oiltight master station showing method of mounting

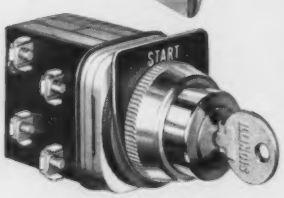


Pendent type oiltight push button stations available with 2 to 10 buttons & pilot lights.

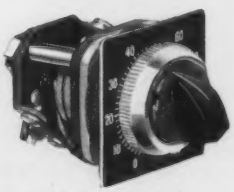
ALLEN-BRADLEY OILTIGHT PUSH BUTTON LINE

that *Satisfies Every Requirement*

Jog button with Start button and Stop & Jog lever



Cylinder lock button



Potentiometer unit

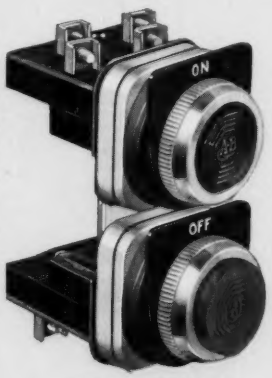
Pilot light Transformer type

Here are a few Allen-Bradley oiltight push button units for machine tools that can be used in endless combinations. All have a flexible, oiltight diaphragm between button and contact block to exclude oil or cutting fluids from contacts. The silver contacts are maintenance free.

Contact blocks may be assembled interchangeably with any type of button. They are available with 1 NO-NC; 2 NO-NC; 4 NO-NC; 2 NO; or 2 NC contacts. Pilot lights of matching design are standard items. See the A-B Handy Catalog for details.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wis.

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.



Two-button maintained contact button

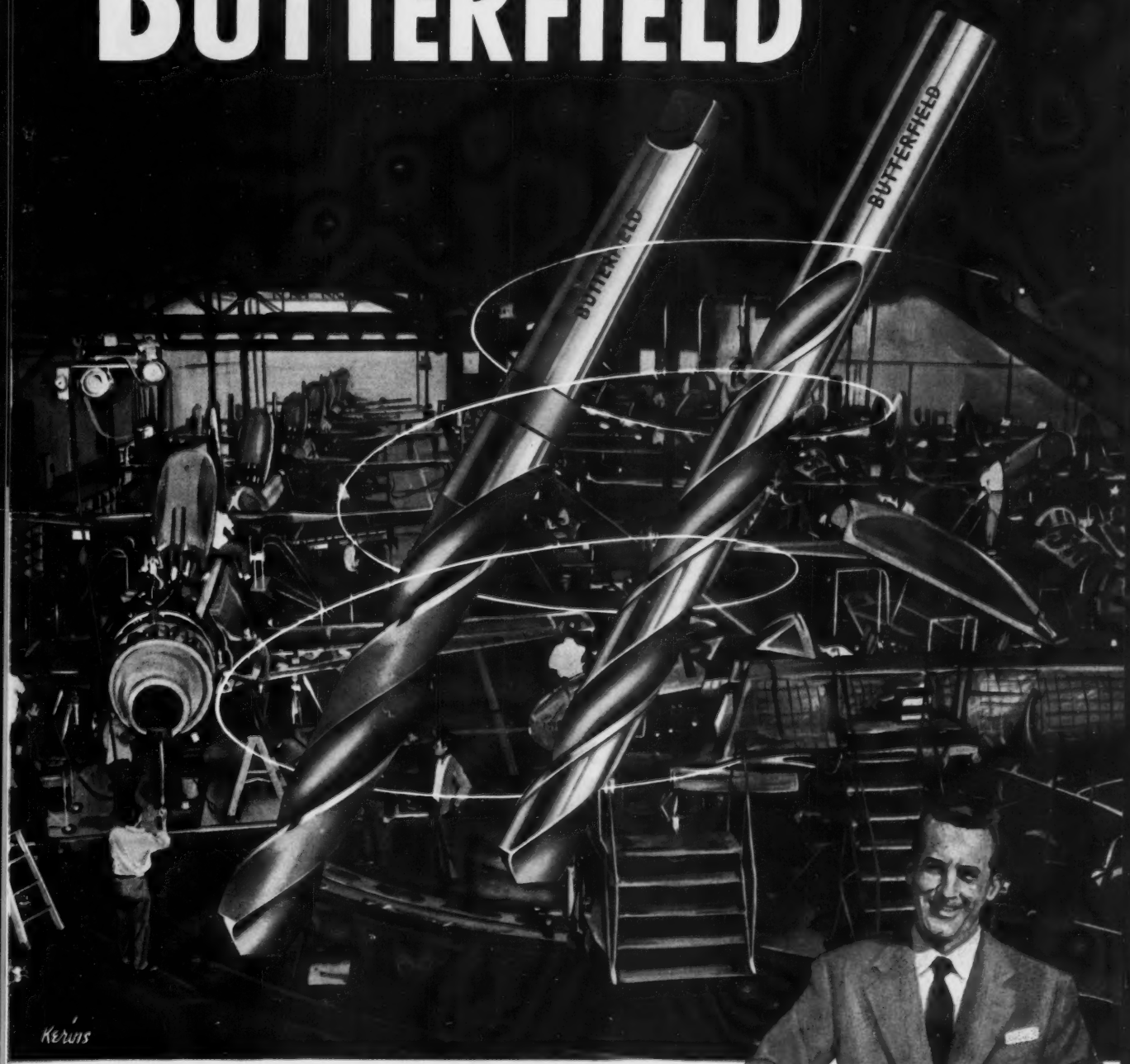
5-55-RM

A-B Quality

ALLEN-BRADLEY QUALITY

BULLETIN 800T PUSH BUTTONS

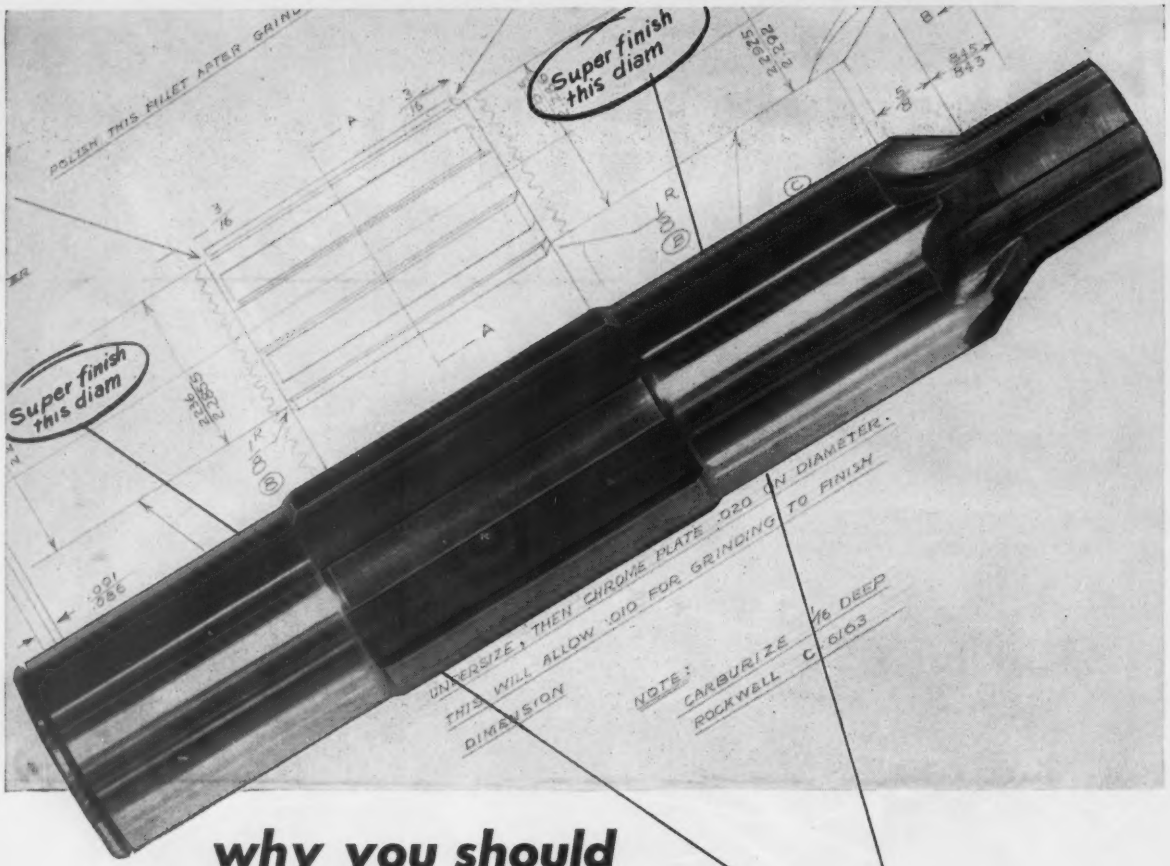
BUTTERFIELD



A COMPLETE LINE OF QUALITY cutting tools is now available from your Butterfield distributor. Drills are made to the same exacting standards as Butterfield Milling Cutters, Taps, Dies, Reamers, Counterbores and End Mills.

FOR FAST, ECONOMICAL SERVICE
CALL YOUR **BUTTERFIELD**
DISTRIBUTOR

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.


Super finish this diam
Super finish this diam
POLISH THIS FILLET AFTER GRIND
UNDERSIZE, THEN CHROME PLATE .020 ON DIAMETER.
THIS WILL ALLOW .010 FOR GRINDING TO FINISH
DIMENSION
NOTE:
CARBURIZE 1/16 DEEP
ROCKWELL C 61/63

why you should put SUPERFINISH *in your blueprints*

Longer life, better performance—yes, and *lower costs, too*—should be engineered into the product at the start. For example: when you specify Gisholt SUPERFINISH, you accomplish two things: First, you assure a bearing surface free of the imperfections that cause wear—a surface that will last indefinitely. Second, you cut the cost of grinding—or even eliminate it. Surprisingly enough, you can in most cases achieve this superlative finish at lower over-all cost than is possible with other methods of finishing.

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GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

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represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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Please send my free copy of "Wear and Surface Finish."

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Company.....
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SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

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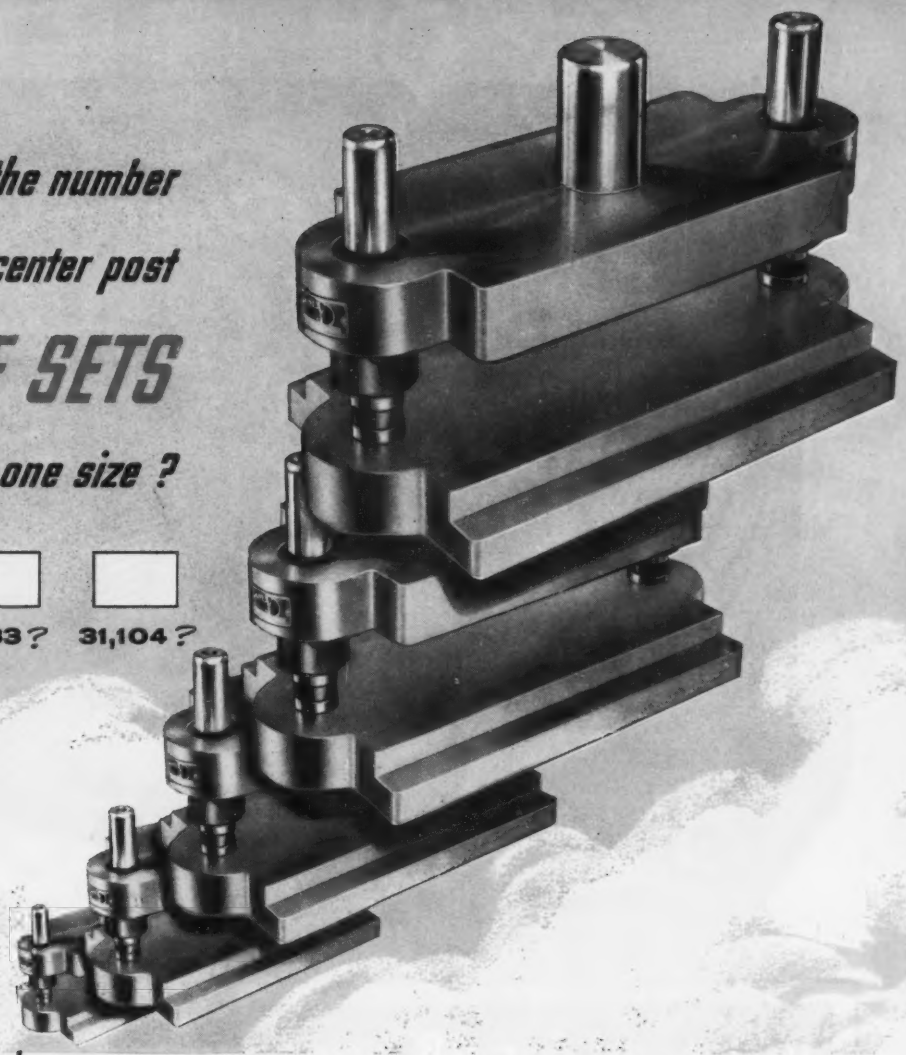
can you guess the number of different center post

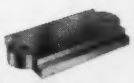
DANLY DIE SETS

in stock–in just one size ?

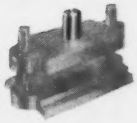
67 ? 575 ? 1433 ? 31,104 ?



3 different punch holder thicknesses

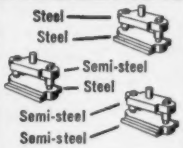


3 different die shoe thicknesses



6 shank size variations

4 bushing type variations



3 different material combinations

16 guide post lengths in each of 3 different styles to choose from

If you guessed 31,104 different standard center post Danly Die Sets in just one size . . . then you were right! Simply multiply together all of the variation possibilities shown in a Danly Catalog for a 12x12 standard center post precision Danly Die Set, and you'll get this remarkable figure. Even more remarkable is the fact that *all* of these variations are cataloged and *stocked* in every Danly Branch.

Just how does this benefit you? This almost unlimited variety of Standard Danly Die Sets in stock at your Danly Branch is your assurance that you can always get the die set you want . . . *when* you want it. That's important in saving tooling time. So remember, when you want the best in die sets—*fast*—the place to call is your local Danly Branch.

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GRAND RAPIDS
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Ducommun Metals & Supply Co.,
4890 South Alameda

MILWAUKEE 2
111 E. Wisconsin Avenue

PHILADELPHIA 40
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ROCHESTER 6
33 Rutter Street

ST. LOUIS 8
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2005 West Genesee Street

DANLY

DIE SETS . . .
STANDARD OR SPECIAL
DIEMAKERS SUPPLIES

you'll want
COMPLETE DETAILS
on these
Reducers

...they're in
a CLASS by
themselves

PHILLIE GEAR®

just send for 48 page
CATALOG H-49

. . . in the meantime, note the following features of this Philadelphia Double Herringbone Reducer:

Symmetrical arrangement and balance of gears in relation to the centerline of housing (as compared to usual offset method).

First reduction is through double Helical Gears and pinions, and *Final reduction* is through continuous tooth Herringbone Gear and Pinion.

Anti-friction bearings of generous proportions, on the ends of each shaft, help absorb the load equally.

Husky, spacious housing, well ribbed and properly sized to give an adequate oil reservoir and large radiating surface for thermal capacity.

These are a few of the exclusive and proven features that have made Philadelphia Units a leader in the field for years.

These Units are available in Single, Double and Triple Reductions . . . ratios from 1.75 to 1 in the Single Unit — up to 292 to 1 in the Triple Unit. Be sure to send for 48 page Catalog H-49.

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ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
Virginia Gear & Machine Corp., Lynchburg, Va.

Industrial Gears & Speed Reducers

LimiTorque Valve Controls

ESTABLISHED 1892

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HUB of production

This is an R. D. Wood 3,000-ton high-speed forging and cogging hydraulic press. It is used for a variety of work—forming, forcing, upsetting, impact extrusion. It handles aluminum, bronze, magnesium, steel, brass, and other metals. It is an essential part of accurate mass metal component production—and is representative only of a wide range of hydraulic presses for all metalworking operations within the automotive and aircraft industries. Write for additional information.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE
ACCUMULATORS
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INTENSIFIERS

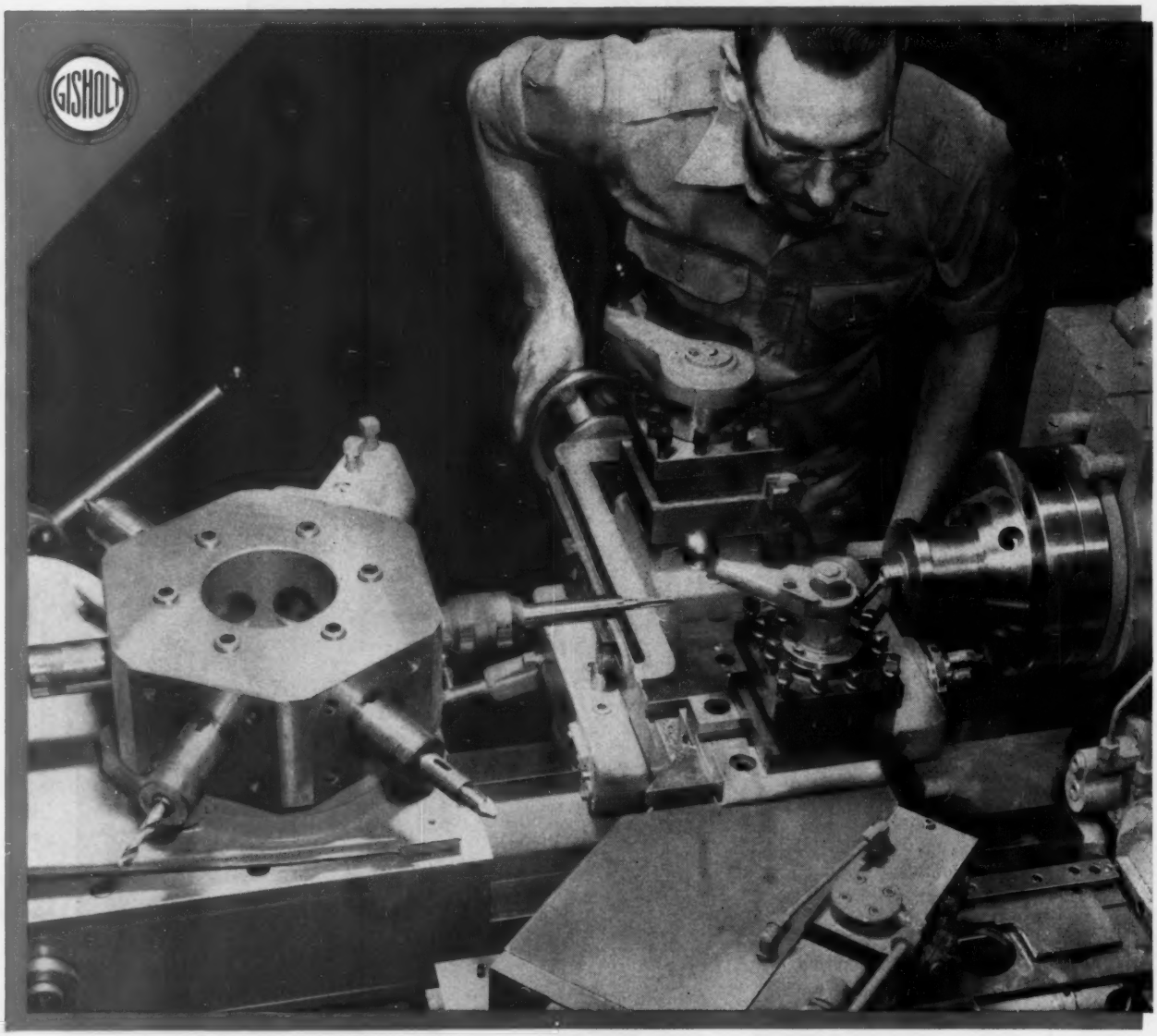
R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING, PHILADELPHIA 5, PA.

Established 1803

WOOD

Turret lathe output and with Scully-Jones



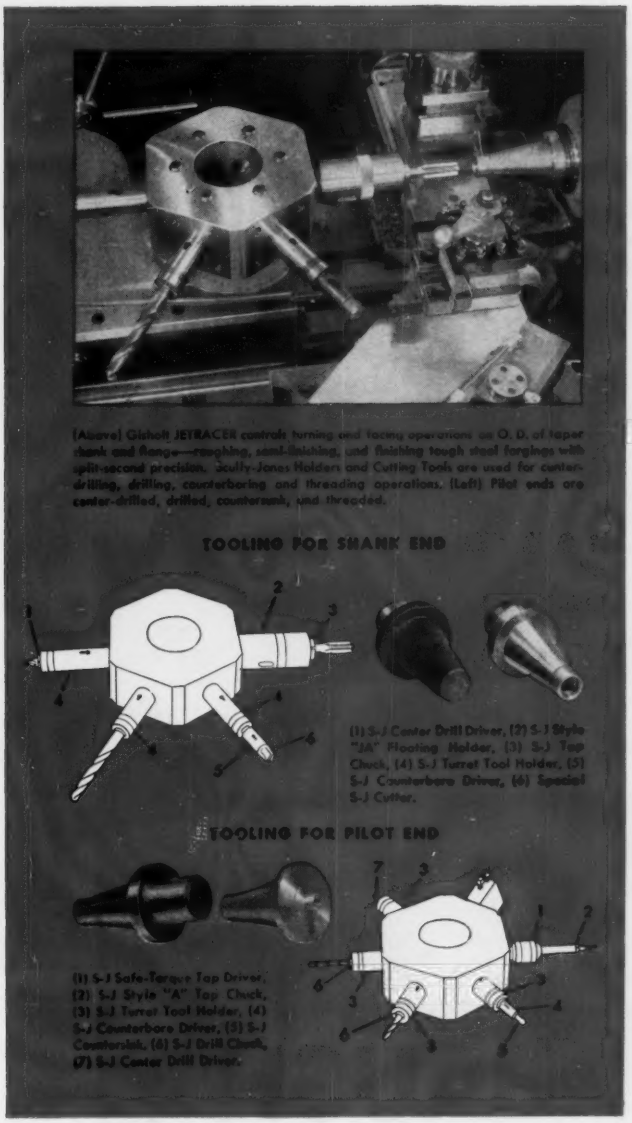
SCULLY JONES

"Precision Holding" solves diversified tooling problems on Gisholt Turret Lathe

This Gisholt No. 5 Ram Type Turret Lathe—a machine that's truly easy to operate—is equipped with hydraulic tracer and nine different Scully-Jones "Precision Holding" Tools in the hex turret (for two setups). It will be exhibited by Gisholt Machine Company in Chicago next September at the Machine Tool Show—Booth No. 1413.

See this exciting demonstration of accuracy and high production on a Gisholt Lathe performing 11 diversified operations on two ends of Scully-Jones Shell End Mill Arbors.

accuracy assured . . .
Holders in the hex turret



[Above] Gisholt JETRACER controls turning and facing operations on O. D. of taper shank and flange—roughing, semi-finishing, and finishing tough steel forgings with split-second precision. Scully-Jones Holders and Cutting Tools are used for center-drilling, drilling, counterboring and threading operations. [Left] Pilot ends are center-drilled, drilled, countersunk, and threaded.

(1) S-J Center Drill Driver, (2) S-J Style "JA" Floating Holder, (3) S-J Tap Chuck, (4) S-J Turret Tool Holder, (5) S-J Counterbore Driver, (6) Special S-J Cutter.

(1) S-J Safe-Torque Tap Driver, (2) S-J Style "A" Tap Chuck, (3) S-J Turret Tool Holder, (4) S-J Counterbore Driver, (5) S-J Countersink, (6) S-J Drill Chuck, (7) S-J Center Drill Driver.

Take full advantage of turret lathe accuracy and productivity, reduce tooling costs, and make the job easier by putting Scully-Jones Holders in the hex turret.

Look at the *extra* gains on this job! Turret Tool Holders and Counterbore Drivers have the *new* "Keyhole" drift slots—an exclusive Scully-Jones feature—which make tool changes faster, easier, and safer. With the "Keyhole" ejection method, possible tool and machine damage is eliminated. Powerful pressure is exerted directly behind the tool simply by turning the camshaped ejector.

The Safe-Torque Tap Driver—another *new* Scully-Jones tool—increases tap life greatly (as high as 500% on some jobs), permits tapping at full speed to full depth, and helps produce more uniform, accurate threads.

And Scully-Jones Drill and Tap Chucks, with improved 4-slot design, provide increased resistance to pull-out, improved seating and collet action, more protection against tool breakage and production shutdowns.

Not only do Scully-Jones tools give you *more that's new* in holding and driving methods, but there's a sureness, a greater measure of accuracy, a new factor of dependability that puts a "Scully-Jones-equipped" turret lathe in a cost class all by itself.

So, when you buy or *retool* a machine tool, make sure it's equipped with Scully-Jones "Precision Holding" Tools. Call your Scully-Jones representative or distributor—factory-trained "Precision Tool and Work Holding Specialist"—for information and service.

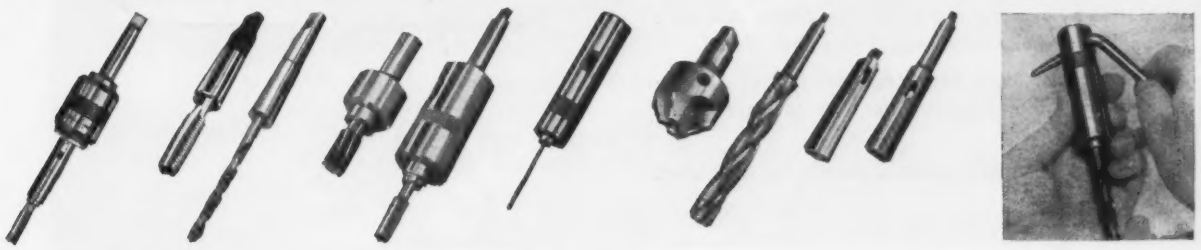
SCULLY JONES

SCULLY-JONES

"Precision Holding" for holding precision

Scully-Jones and Company, 1906 S. Rockwell Street, Chicago 8, Illinois

Safe-Torque Tap Drivers | Drill and Tap Chucks | Floating Holders | Turret Tool Holders | Cutting Tools and Holders | Sleeves and Sockets | New "Keyhole" Tool Ejection Method



British Jets via BAUSH AUTOMATION

The Baush Vertical Dual Column Quill Feed Cam Unit Machine illustrated was designed and built to do one job, and one job ONLY, on British Jet parts:

> *To drill and ream a total of 97 holes, .220" diam. on an 18.946" diam. bolt circle through a double flange in stainless steel Compressor Rotor Wheels, without being touched by the operator.*

Each of these Baush units is furnished with a single spindle—one unit for drilling and one unit for reaming. Automatic hydraulic indexing fixture with stationary bushings guides drills and reamers.

Once the part is loaded into fixture and machine is started by operator, the cycle is completely automatic until all 97 holes have been drilled and reamed.

Why not use Baush knowledge and ingenuity of design to build machine tools for your special machine operations.

Send us your prints today — there is no obligation.

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MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

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Improved CLEVELAND *High Speed* COUNTERBORES

New Flute Design for More Efficient Chip Removal

Deeper flutes eliminate "packing" of chips and reduce tool breakage . . . enable you to counterbore the full length of the flutes. This *superior tool* also gives you the *economy* of interchangeable pilots. It requires no holders or adapters. ◈ A test will prove the outstanding features of these improved CLEVELAND Counterbores.

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. . . designed for high speed second-operation work. Write for literature which describes a drive that is **unique in the industry.**

Send for descriptive circular on the **WADE NO. 73 HAND SCREW MACHINE**

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THE WADE TOOL CO.

WALTHAM 54, MASS., U. S. A.

MAKERS OF PRECISION TOOLS FOR AMERICAN INDUSTRY

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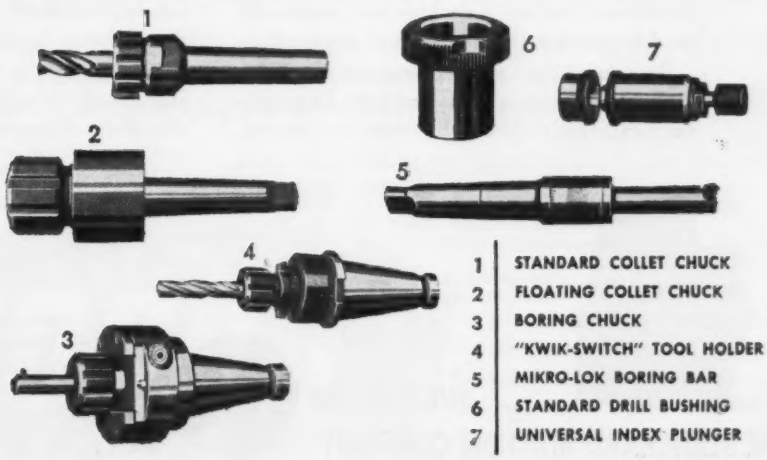
UNIVERSAL
DRILL BUSHINGS OUTLAST THEM ALL!

Several factors contribute to the long life of Universal Drill Bushings. They are machined from an unusually high quality steel. Their superfinish bores reduce wear. The blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests help guarantee their accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you — Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis. — or our home office.

180

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2,
MICHIGAN



1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

16 surfaces

...on this Garrison Gear Chuck

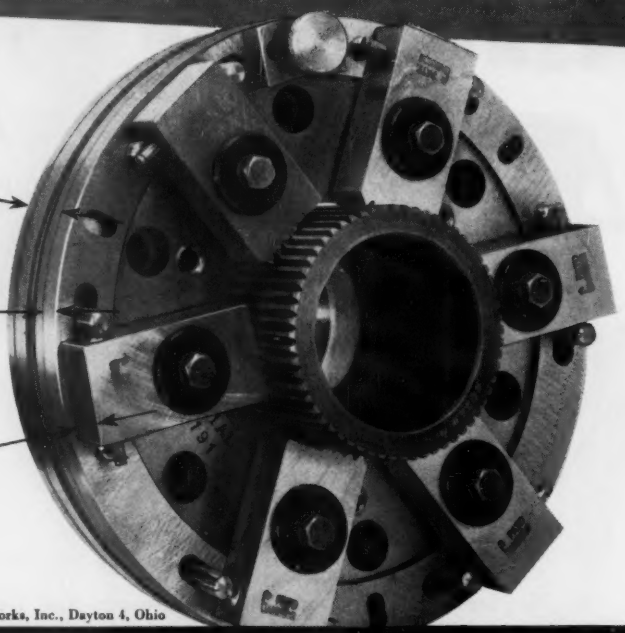


Photo courtesy of Garrison Machine Works, Inc., Dayton 4, Ohio

are Blanchard ground for precision

As every machinist knows, machine tools impart their precision through their chucks. That's why chuck dimensions and tolerances are of critical importance . . . and why Blanchard Surface Grinders are commonly used to produce the flat surfaces required.

Blanchard Surface Grinders are ideal for all kinds of precision grinding jobs. They produce extremely close tolerances for flatness, size and parallelism . . . *at low costs and high production rates.* Many Blanchard users grind surfaces flat to within 2 to 4 light bands, parallel to less than .0001", with dimension tolerance of .0002", and surface finish to better than 3 micro inches.

Whether your work involves precision machining or rapid removal of stock, take the advice of master machinists . . .

PUT IT ON THE BLANCHARD

No. 11 Blanchard Surface Grinder

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE **BLANCHARD**

THE BLANCHARD MACHINE COMPANY

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Ten Million TOCCO*-Hardened Axle Shafts

Battery of TOCCO machines for hardening automotive axle shafts. TOCCO*-hardened shafts show an increase of up to 200% in resistance to torsional fatigue over furnace-hardened shafts made of alloy steel.

Give Super Service to American Motorists

...Save Manufacturers $2,000,000

The application of TOCCO* Induction Heating to the surface hardening of rear axle drive shafts for passenger cars and trucks provides a fine example of how a less expensive manufacturing method often results in the best possible end product.

For instance, TOCCO* Induction Hardening permits the substitution of easier machining carbon steels for expensive alloys, saving from 25¢ to 55¢ per car in material costs alone. Additional savings result from the fact that TOCCO eliminates the need for annealing, tempering and shot peening operations formerly required. Moreover, long hauls to and from the heat-treating department are eliminated because cool, clean TOCCO* fits right in the production line—next to related operations.

If you make parts that require hardening, annealing, brazing, or heating for forging or forming, it can pay you handsome dividends to investigate TOCCO* Induction Heating as a sound method of improving product quality *while reducing costs.*

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Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

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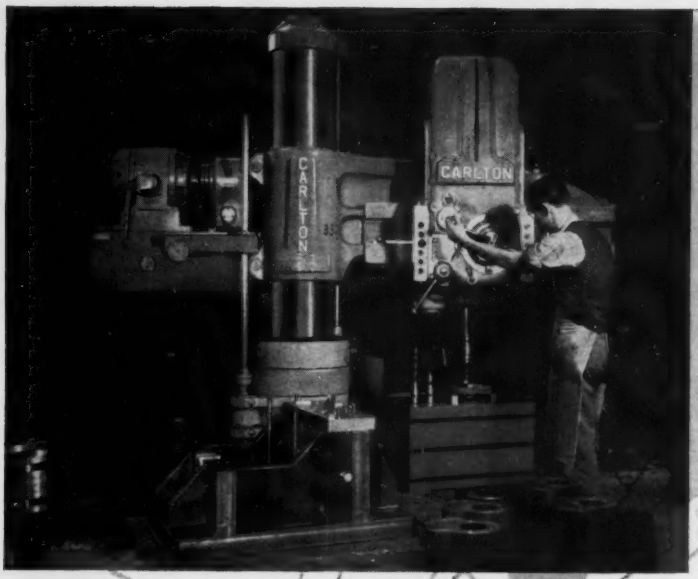
CARLTON
CARLTON
WEST
SOUTH



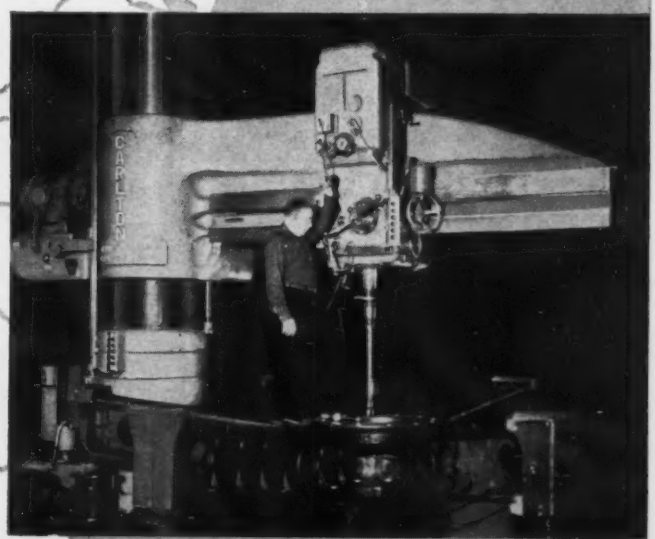
NORTH Carlton 3A radial drill machining a cam used on an automatic concrete block machine manufactured by the Besser Co., Alpena, Mich. Precision, rigidity and pushbutton control make Carlton first choice at Besser Co.

all over the U. S.

Carlton radial drills available in arm lengths from 3-ft. to 12-ft., and column diameters from 9" to 26". Carlton horizontal drills made in 4H and 5H sizes. For complete information, call your machine tool distributor, see the Carlton brochure in Sweets Machine Tool Catalog file, or write The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton can cut your drilling costs, too . . . in three ways: (1) Because Carlton can handle a broader range of work (¼" to 10" diameter holes on the 19" column 4A, for example), you need less drilling equipment. (2) With Carlton accuracy you drill it right the first time—there's no lost motion. (3) And with the help of Carlton engineered tooling, you can be sure of higher drilling rates. Why not write us today and get the 'hole' story? The Carlton Machine Tool Co., Cincinnati 25, Ohio.

"THE HOLE STORY" gives complete information and specifications on Carlton OA, 1A, 3A, 4A and 5A radial drills. Write for your copy . . . please specify size desired.



EAST Westinghouse Electric Corp., East Pittsburgh, selected this Carlton 5A radial because of its enormous capacity. The Carlton honing attachment shown provides uniformity of hole size to within 1 micro-inch.

Carlton
Horizontal and radial drills

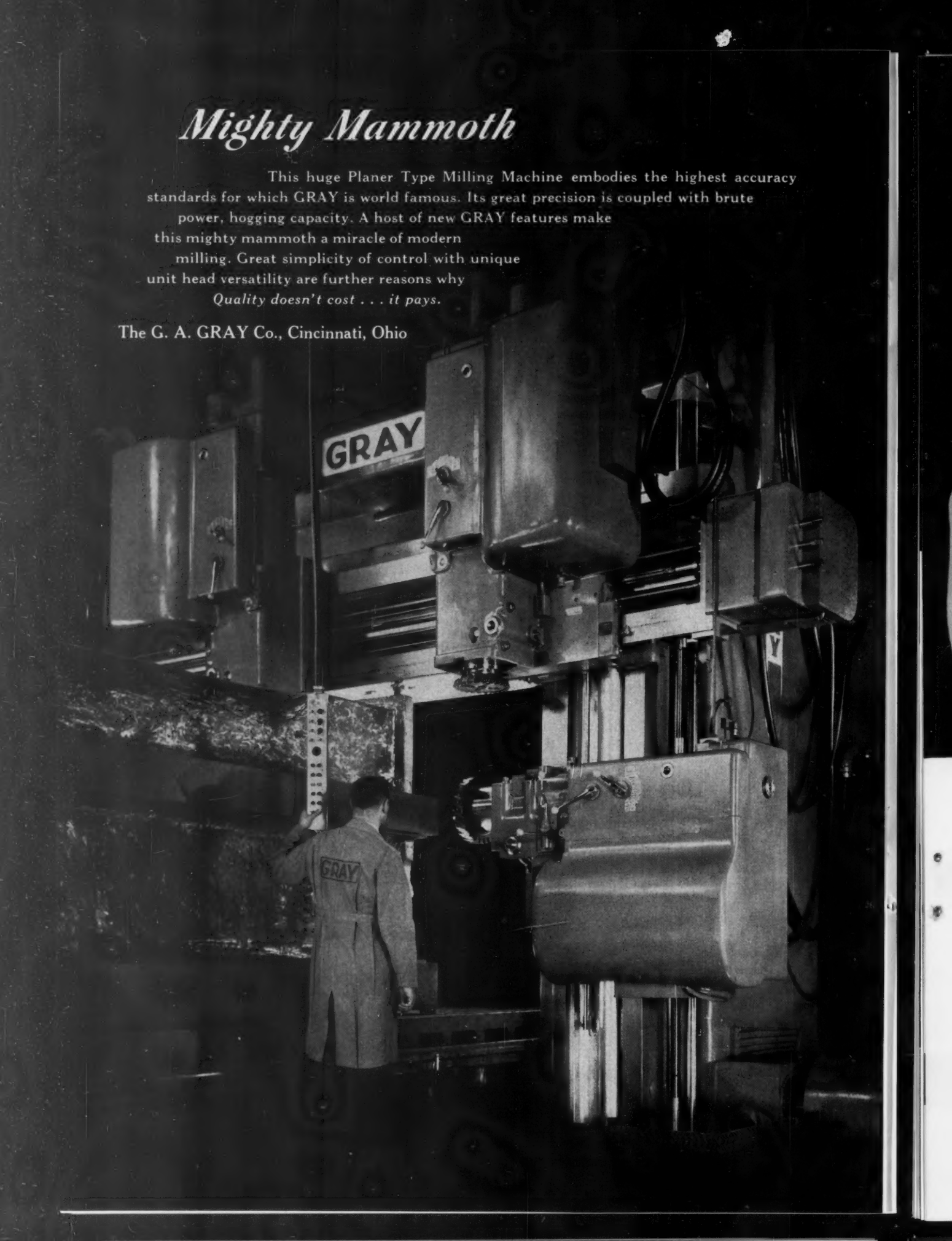
THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO

Mighty Mammoth

This huge Planer Type Milling Machine embodies the highest accuracy standards for which GRAY is world famous. Its great precision is coupled with brute power, hogging capacity. A host of new GRAY features make this mighty mammoth a miracle of modern milling. Great simplicity of control with unique unit head versatility are further reasons why

Quality doesn't cost . . . it pays.

The G. A. GRAY Co., Cincinnati, Ohio



new PRATT & WHITNEY

48 inch precision VERTICAL ROTARY TABLE

LATEST ADDITION TO THE COMPLETE P&W LINE OF PLAIN, TILTING and VERTICAL ROTARY TABLES

This rugged, new Rotary Table is designed especially for inspecting large, heavy work pieces . . . such as aircraft parts, machine elements, jigs, fixtures and other precision products . . . with speed, ease and accuracy. It can also be used to provide precise work location on heavy equipment for boring, face milling and other machining operations.

Table dial graduations read direct to 1 minute of arc, vernier graduations to **2 seconds**. Fast power rotation, in either direction, is provided by a ¾ hp reversible motor. Like all P&W Precision Rotary Tables, this new 48" Model is hand scraped and inspected to rigid standards of accuracy.

PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

WEST HARTFORD 1, CONNECTICUT, U.S.A.

BRANCH OFFICES . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • HOUSTON (The Stanco Co.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., W. HARTFORD

P&W FACTORY-DIRECT SERVICE

To provide expert application engineering service, all Pratt & Whitney products are made available to you only through our own Factory-Direct Representatives. Each a specialist, these men — working from Branch Offices conveniently located throughout the country — are fully qualified by training and experience to help solve your production problems . . . to help you select equipment exactly right for your specific needs.

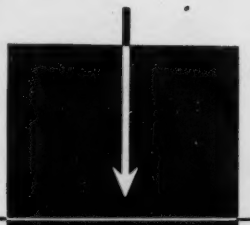
FIRST CHOICE FOR ACCURACY SINCE 1860

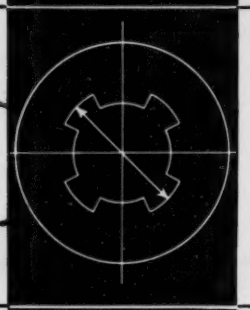
MACHINE TOOLS • CUTTING TOOLS • GAGES

NUMBER THREE IN A SERIES

What's The Best Way To Gage These Parts ?

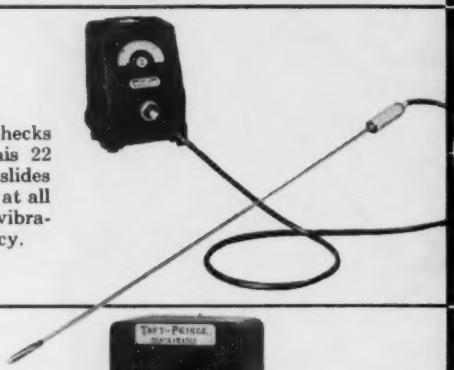
Tips from Taft-Peirce on when and where to use a T-P CompAIRator Air Gage

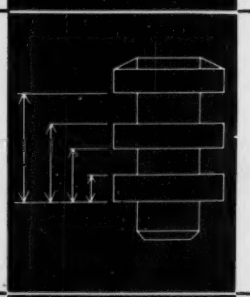




Helical Groove Diameter
Tolerance: .002″

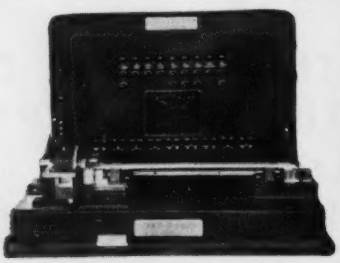
A single dial T-P CompAIRator Air Gage checks the helical rifling groove diameters in this 22 caliber rifle bore 32″ long. Gaging member slides in and out of bore, checks groove diameter at all points. Extremely sensitive yet sturdy — vibration, jarring, tilting won't disturb its accuracy.

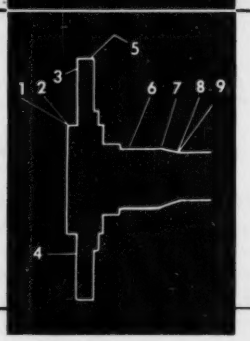




Four Heights
Tolerance: .002″

One four dial T-P CompAIRator checks four land heights simultaneously on this spool valve. Tilted line-type dials facilitate reading. Pointer action is positive, instantaneous. CompAIRators can be designed to check any specific tolerance range from .0001″ to .125″.





OD, Squareness, Runout, Concentricity
Tolerances: from .0005″ to .003″

This T-P CompAIRator combines air-electric, standard air, and computing air circuits to check 5 diameters, 2 runouts, one flatness, and one concentricity simultaneously on auto rear axles. Lights indicate dimensions out of tolerance. Exclusive T-P Computing CompAIRator circuits figure runout, flatness and concentricity. Eliminate usual four measurements and computations.

For more examples and the complete story on Taft-Peirce CompAIRator Air Gages send for Bulletin.

WHAT IS A COMPAIRATOR AIR GAGE?

A CompAIRator is a sensitive gaging instrument that measures variations in the velocity of tiny jets of air. When work is placed over these jets, air flow is restricted and its velocity reduced. Any change in air velocity reflects a change in part size, which is immediately shown on a calibrated indicator. Since only air contacts the part in most cases, there is minimum wear on gaging members. Fast, accurate, dependable, a T-P CompAIRator is simple to operate, requires little or no maintenance.

STANDARD AND SPECIAL COMPAIRATORS | COMPUTING COMPAIRATORS | AUTOMATIC SORTING MACHINE | AIR ELECTRIC COMPAIRATORS

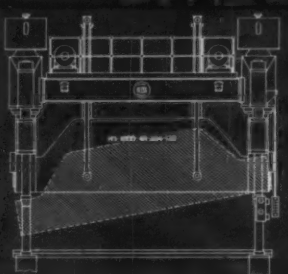
T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

For more information on products advertised, use Inquiry Card, page 277

NAVAL SHIPYARDS STEP UP PRODUCTION WITH...

BLISS 1000-TON KEEL BENDERS



Rocking action illustrated: slide comes down on work and then rocks back and forth to bend it into desired shape. Key to this smooth rocking action is the fact that weeks were spent in hand-finishing the mirror-like seats at the ends.

At Boston Naval Shipyard, this 1000-ton Bliss keel bender shapes hull, bulkhead and keel plates up to 22 feet long and 10 feet wide—faster, easier and at less cost than previous installations. And here's why...

This press operates like a press brake, but has a unique and different slide (ram) action—it can be moved up or down on an angle and rocked back and forth. With this "skewing" action and properly designed dies, this hydraulic press can form the many different hull and keel plates needed.

The "skewing" action is achieved this way: the pressing beam, while rigidly secured in the slide housings, is flexibly mounted in the crossheads on mirror-like ball seats. This permits the full action desired and gives the press its versatility. The result is a wide choice of pressing combinations and greatly increased production.

In fact, the Navy reports it's "a decided improvement" over older units. Recently, a twin bender was installed at the Charleston (S. C.) Naval Shipyard.

These keel benders, though unique, are actually only recent examples in our history of tackling the difficult in press building. If you are faced with an unusual press engineering problem, why not let a Bliss representative give you the benefit of our collective experience.

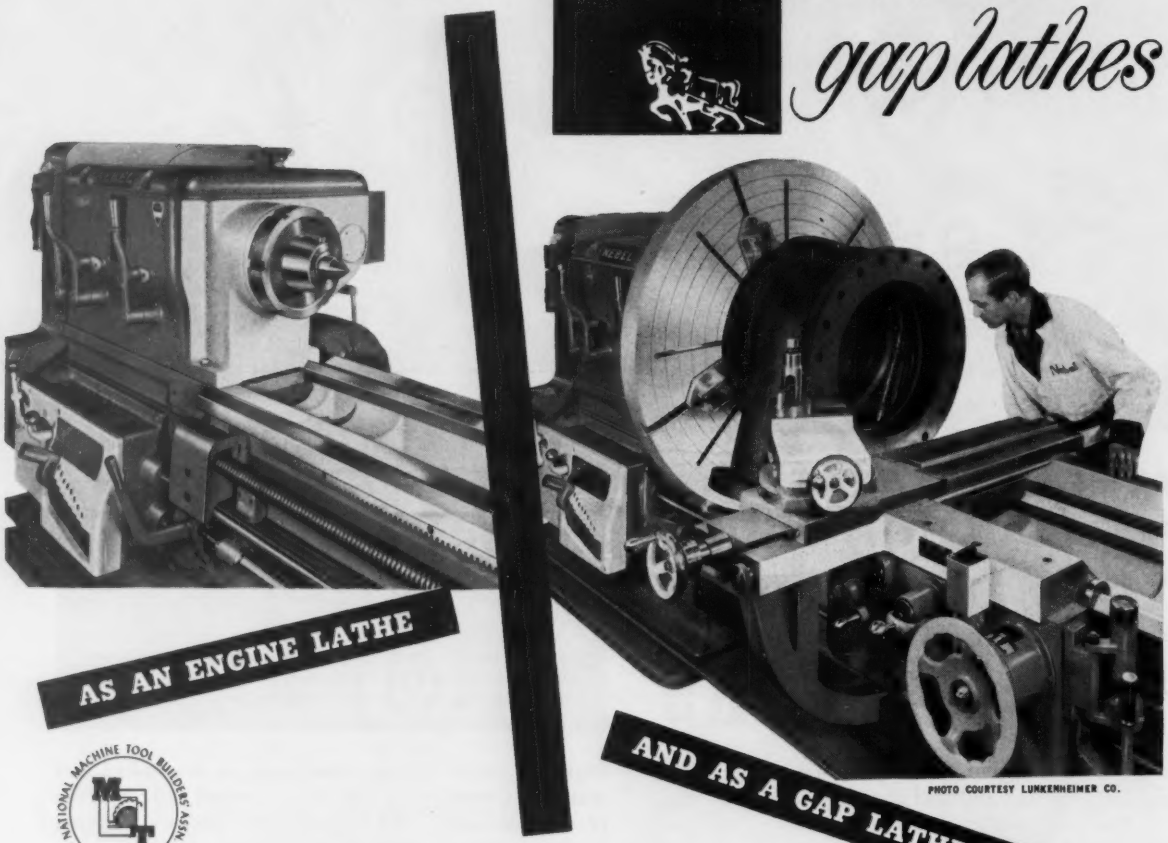
E. W. BLISS COMPANY, Canton, Ohio
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

BLISS
SINCE 1857

is more than a name... it's a guarantee

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Mich.; San Jose, Calif.; Pittsburgh and Midland, Penna. *Branch Offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Pittsburgh, Rochester, Salem, San Jose, Toledo, Washington, D. C.; and Toronto, Canada. *Other representatives throughout the world.*
E. W. Bliss (England) Ltd., Derby — E. W. Bliss Co. (Paris), France

double duty Nebel *gap lathes*



AS AN ENGINE LATHE

AND AS A GAP LATHE . . .

PHOTO COURTESY LUNKENHEIMER CO.

NATIONAL MACHINE TOOL BUILDERS' ASSN. MEMBERS OF

Nebel lathes meet U. S. government standards

for Army, Navy, Air Force and atomic energy projects . . .

and have been approved by industry since 1889.

This big Nebel extension bed gap lathe outperforms two standard lathes. Yet it requires the *floor space of just one lathe* . . . and you make *but one investment* for this doubly useful, dual purpose lathe.

Nebel gap lathes made in two extension bed gap models: 28″/50″ (illustrated) and 20″/40″. . . and in removable block gap models.

send for descriptive bulletins

★ **THE NEBEL MACHINE TOOL CO.**
3410 CENTRAL PARKWAY
CINCINNATI, OHIO

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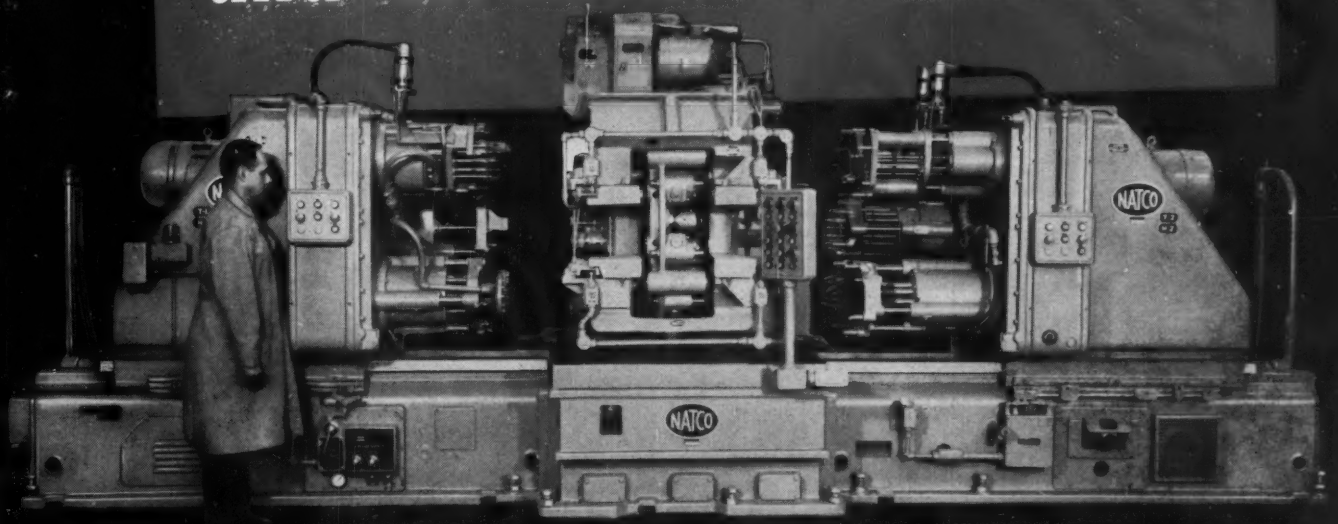
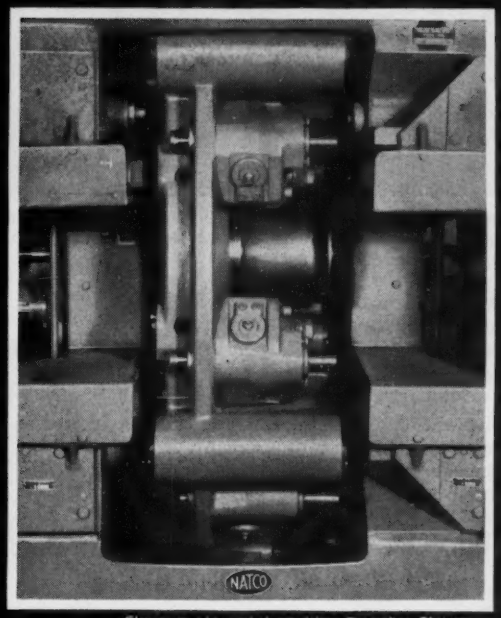
COMBINING OPERATIONS on a NATCO Cut Costs and Increased Production!



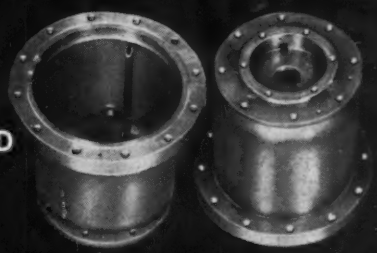


Close-up view of 6 position Trunnion Fixture

109 REFRIGERATOR COMPRESSOR SHELLS PER HOUR

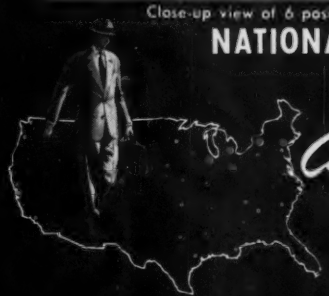
Estimated Gross Production

DRILLED
COUNTERBORED
REAMED, TAPPED
CHAMFERED
BURRED



Total . . . . . 77 OPERATIONS

NATIONAL AUTOMATIC TOOL COMPANY, INC.
RICHMOND, INDIANA



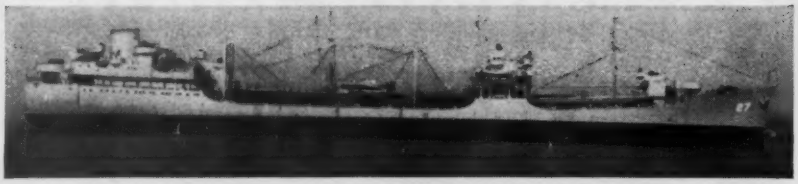
for problems in Drilling, Boring, Facing and Tapping

Call a Natco Field Engineer

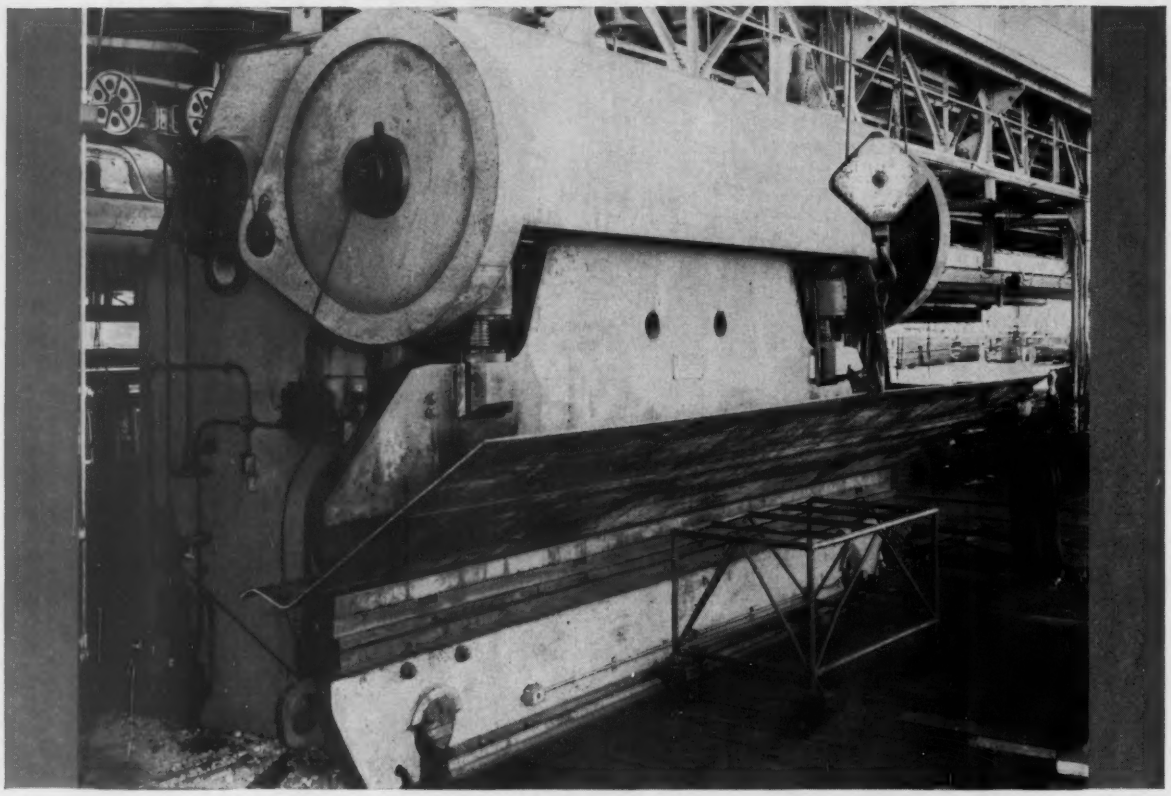
CHICAGO, *Room 203, 6429 W. North Ave., Oak Park*
DETROIT, *10138 W. McNichols Rd.*
BUFFALO, *1807 Elmwood Ave.*
NEW YORK, *35 Beechwood Ave., Mount Vernon*

NATCO

U.S.S. KASKASKIA is typical of many ships which have had extensive bulkhead and other repairs at Moore Dry Dock Company.
Official U. S. Navy Photograph



Moore Dry Dock SPEEDS MARINE REPAIRS



Fluted bulkhead plate being formed by Steelweld bending press in plate shop of Moore Dry Dock Company for bulkhead renewal job on U.S.S. "KASKASKIA" (A027). Size of plate: length 26', width 6', thickness ½".

Long a leading West Coast ship builder and marine repairs concern, the Moore Dry Dock Company, Oakland, California, has found a large Steelweld Bending Press to be a great asset in speeding the forming of heavy plate.

Ship repair, which constitutes an important part of the company's business, often requires replacement of large sections, such as bulkheads. This necessitates the forming of plates to various shapes to accurately replace those removed. Because of the power of their Steelweld and the ease of making adjustments, this work is carried on efficiently and satisfactorily.

The entire line of Steelwelds has an enviable reputation for continuous high-production performance. We urge you to get the facts on their many outstanding features.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
5462 E. 281 St., Wickliffe, Ohio

STEELWELD
BENDING PRESSES
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

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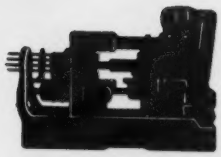
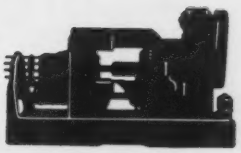
with the addition of

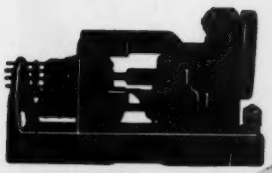
4 New Models



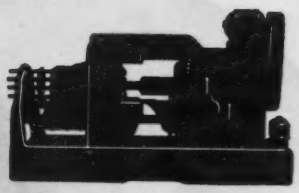
NEW 5/8" RA-8



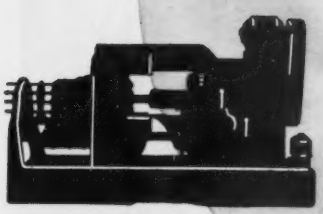
NEW 1¼" RB-8



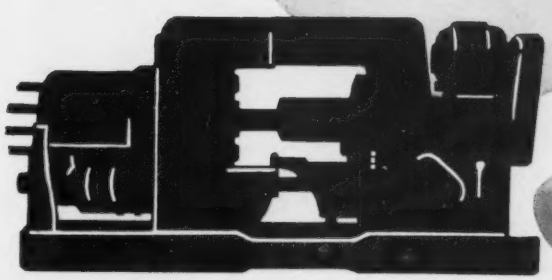
1⅝" RB-8



2⅝" RB-8



NEW 3½" RB-8



NEW 4" RB-8

Acme-Gridley 8-spindle advantages now extend to ALL ranges of bar work up to 4" diameters

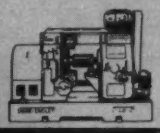
The principal performance advantages of Acme-Gridley 8-spindle bar automatics now can profitably be applied to bar work as small as the capacity range of a ⅝" machine and as large as 4" diameter. These advantages include:

- faster machining cycle time because of additional end working positions;
- "new machine" reliability longer—with carbide or high speed tooling;
- greater accuracy and uniformity of parts with fewer rejects;
- completion of a greater number of secondary operations in the primary machine setup (spindle stopping mechanism optional), with consequent savings in man hours, floor space and machine investment.

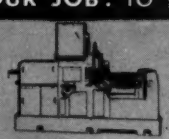
And for help-when-you-need-it, these new models (and all Acme-Gridleys) are backed up by a wealth of "*complete line*" tooling experience (literally thousands of tooling setups) plus a policy for service which has always played a mighty prominent part in maintaining National Acme's position of leadership.

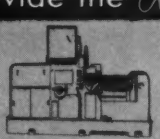
It will pay you to plan your production the modern Acme-Gridley 8-spindle way. Why not ask us to tell you more about it?

SEE US AT THE MACHINE TOOL SHOW • SEPTEMBER 6 TO 17 • BOOTH NUMBERS 324 AND 708



OUR JOB: to provide the *Right Machine* for YOUR JOB





Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

THE NATIONAL ACME COMPANY

179 EAST 131st STREET • CLEVELAND 8, OHIO

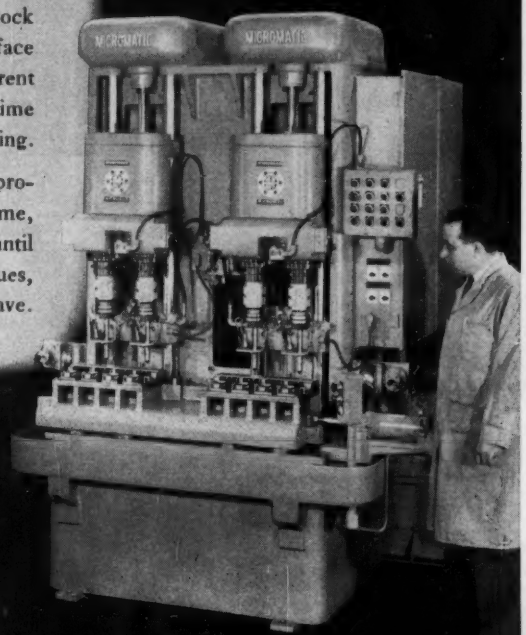
The man who needs a new machine tool and doesn't buy it is paying for it anyway...

in lost production

Because costs are set largely in labor and burden, lost production is reflected directly in high unit cost. Old equipment is not the only cause. Failure to utilize the latest processing techniques may be keeping you from increasing production and lowering unit cost.

For example, consider the low-velocity, controlled-abrading Microhoning process which combines stock removal, geometric accuracy, size control and surface finish to increase *production* and *precision*. Inherent characteristics of Microhoning eliminate such downtime factors as tool sharpening, fixture and machine aligning.

The difference between your current output and the production possible with Microhoning will, in a short time, cover the cost of new Microhoning equipment. And until you do utilize the most efficient processing techniques, you are paying for new machine tools you don't have.



PART:
Connecting rod—wristpin and crankpin bores.

PROBLEM:
High unit cost; how to increase production without increasing labor or burden cost.

SOLUTION:
Microhoning—simplified processing of wristpin bore (eliminating 3 operations); gross production increased to 600 bores per hour, within all specified tolerances.

*MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

MICROMATIC HONE CORPORATION

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MICROMATIC HONE CORP. 2205 Lee Street Evanston, Illinois

MICROMATIC HONE CORP. 1535 Granda Vista Avenue Los Angeles 22, California

MICROMATIC HONE LTD. 320 Grand River Avenue Brantford, Ontario, Canada

MICROMATIC HONE CORP. MICRO-MOLD MFG. DIV. 231 So. Pendleton Avenue Pendleton, Indiana

REPRESENTATIVES: Allied Northwest Machine Tool Corp., 103 S.W. Front Ave., Portland 4, Oregon • Mason Machine Tool Company, 415 So. Second East, Salt Lake City, Utah • Perine Machinery & Supply Co., 1921 First Ave. South, Seattle 4, Washington
REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES

MICRO-PRECISION DIVISION • 2205 Lee Street, Evanston, Illinois
* Hydraulic controls • Diesel fuel injection equipment

Visit Booth 1211 at the Show. See demonstrated how Microhoning increases production.

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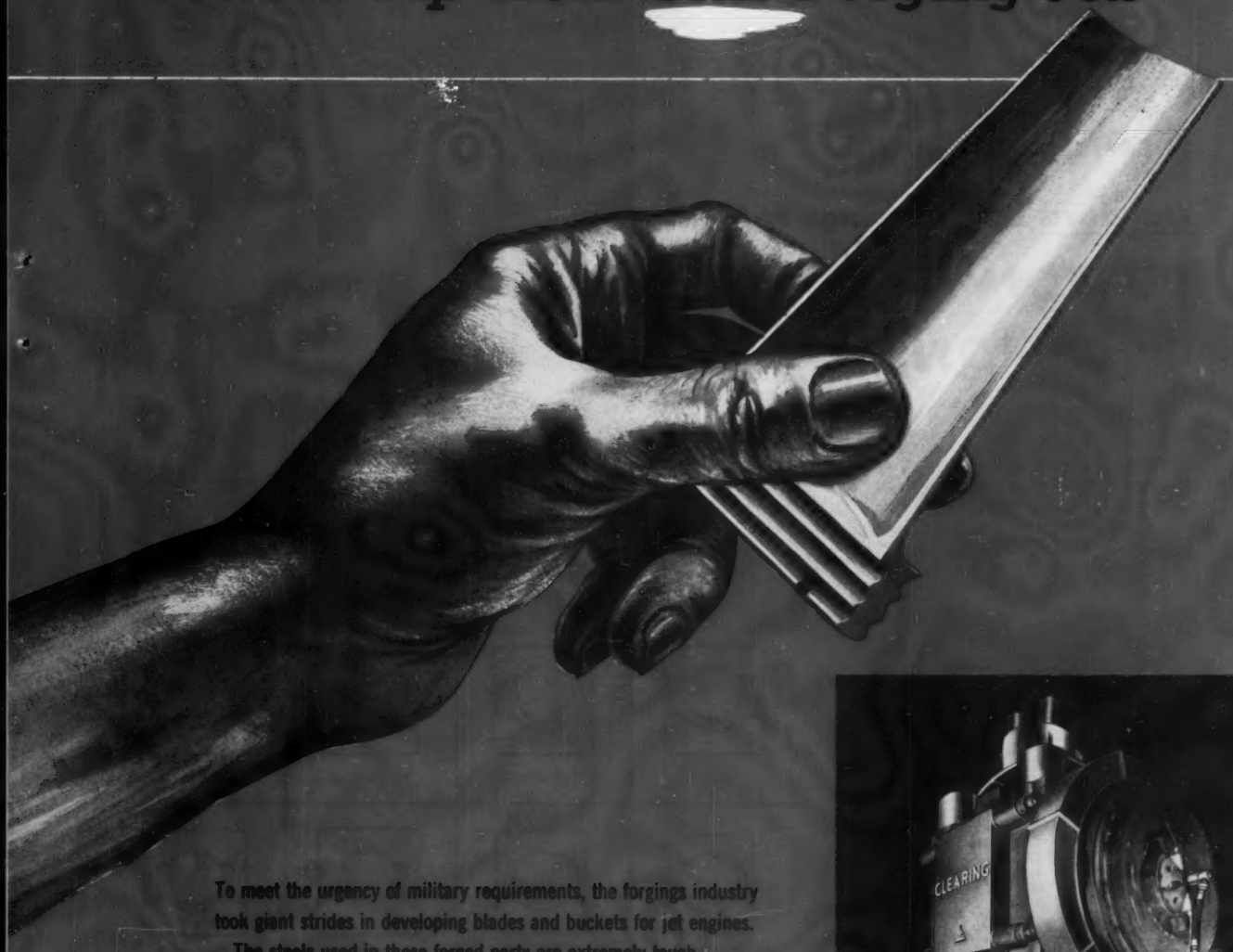
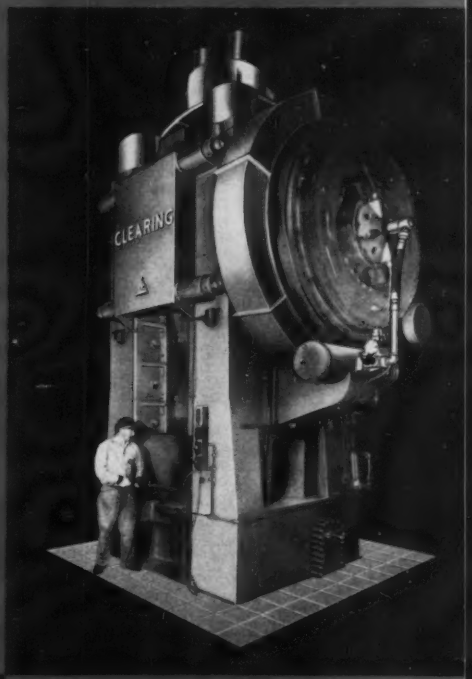
Take a Tip from This Forging Job





To meet the urgency of military requirements, the forgings industry took giant strides in developing blades and buckets for jet engines.

The steels used in these forged parts are extremely tough titanium alloys. Shape of the part is unusually complex and difficult to machine. By working out methods to press forge these parts, the forging industry was able to mass produce them to tolerances that all but eliminate machining and economize on the expensive material, too.

There are many parts like this one which can be produced with much greater economy. This may be true about some parts that you are making. We'd like to send an engineer who can talk your language and share your problems. There'll be no obligation.

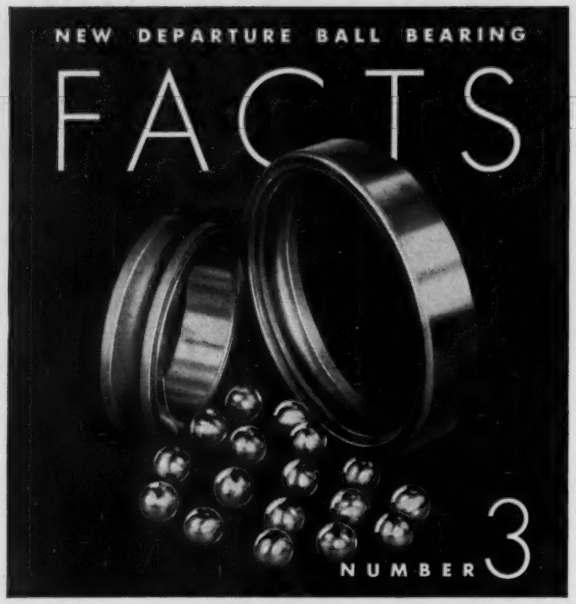
Add this Clearing Forging Press Catalog to your library by writing to us today.

CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

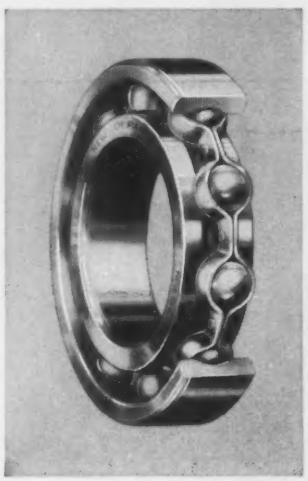
CLEARING MACHINE CORPORATION DIVISION OF **U.S. INDUSTRIES, INC.**

6499 WEST 65TH STREET • CHICAGO 38, ILLINOIS • HAMILTON PLANT — HAMILTON, OHIO

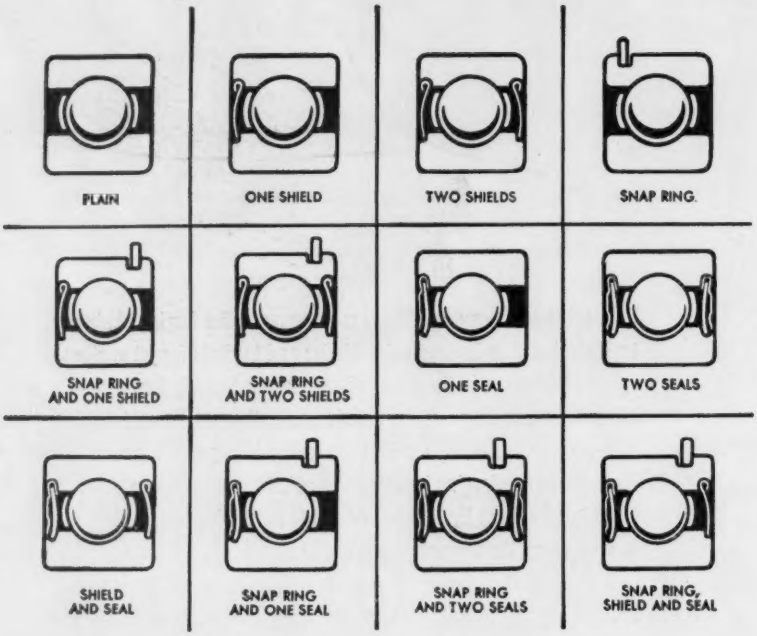


This "wardrobe" fits standard ball bearings to CUSTOM OCCASIONS

Versatile is the word for New Departure standard ball bearings! For these bearings may be obtained in a wide range of *standard* variations (as shown below), opening a tremendous range of uses to the engineer. In other words, a standard bearing has a "wardrobe" which fits it for very nearly any occasion!



New Departure Single Row Conrad-type bearings, with standard variations available, illustrate the "wardrobe" principle which makes these ball bearings, with their dual load-carrying ability, the most readily adaptable of all bearing types.



Virtually any mounting or operating requirement within a wide range of usage is met perfectly by a *standard* New Departure ball bearing, in conjunction with shields, seals, snap ring, or combinations thereof. Shields protect the bearing from ordinary dirt both before and after mounting and, in many cases, provide adequate retention of lubricant. Seals give positive protection against dirt of every kind and make possible enclosed lubrication for extended or even lifetime service. Snap rings allow positive location in housings lacking inside shoulders. Whenever a design or engineering problem involves ball bearings, think of New Departure. Highly experienced ball bearing engineers are always ready to work with you.

Send for Booklet BA-6 on ball bearing application

NEW DEPARTURE
BALL BEARINGS

NOTHING ROLLS LIKE A BALL

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

For more information on products advertised, use Inquiry Card, page 277

On the back of each color TV viewing screen are more than one million phosphor dots (19″ screen) grouped in uniform patterns of red, green and blue. Electron beams registered with each dot are shot at these phosphors—the intensity determining the dominating color.

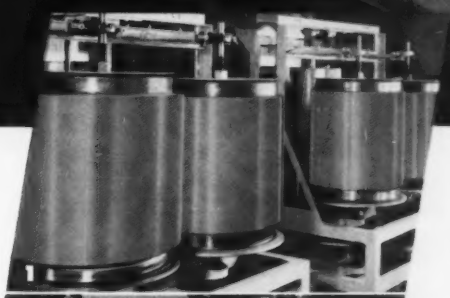
Directly behind the screen in each tube is a Cupro Nickel shadow mask containing more than 400,000 holes. Each hole is registered exactly with its group of phosphor dots on the screen and with the electron beam—the mask controls the register of color—keeps the image sharp —the color true.

Color TV came to ANACONDA

When the television industry needed a shadow mask to control electron beams in the color tube, Buckbee Mears Company, photoengravers of St. Paul, Minnesota, produced it. When they needed thin strip metal in which 2500 perfect holes per square inch could be etched, Anaconda produced it.

When color TV came to Anaconda, we developed a new alloy, 6% Cupro Nickel, with such uniform quality, structure and thickness (0.0075″) that the microscopic holes could be etched without flaw. The new alloy also has the strength and malleability to take forming without distortion of the dot structure, and functions in a color tube without contaminating the vacuum.

Again, a copper alloy has solved a difficult problem. Perhaps yours can be made easier through Anaconda research and development. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.



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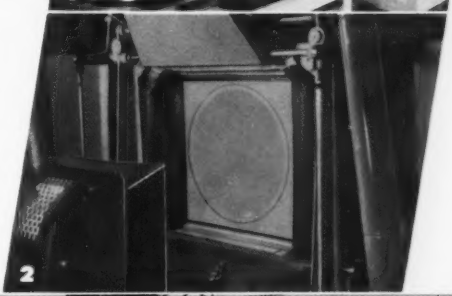

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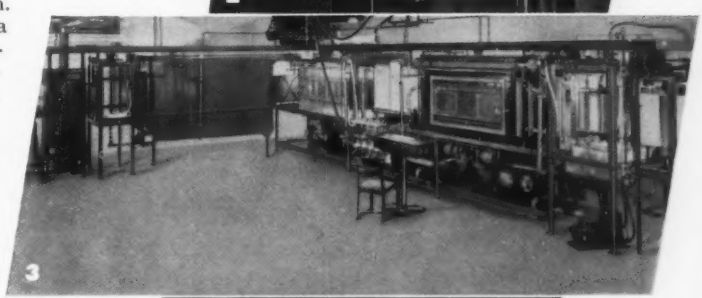


3

4

1 Rolls of the Cupro Nickel strip entering coating machine to be sensitized for photographic printing.

2 Camera printing dot pattern on the sensitized Cupro Nickel strip.

3 Printed Cupro Nickel strip at right entering etching machine where acid baths plus washing and rinsing operations produce finished mask.

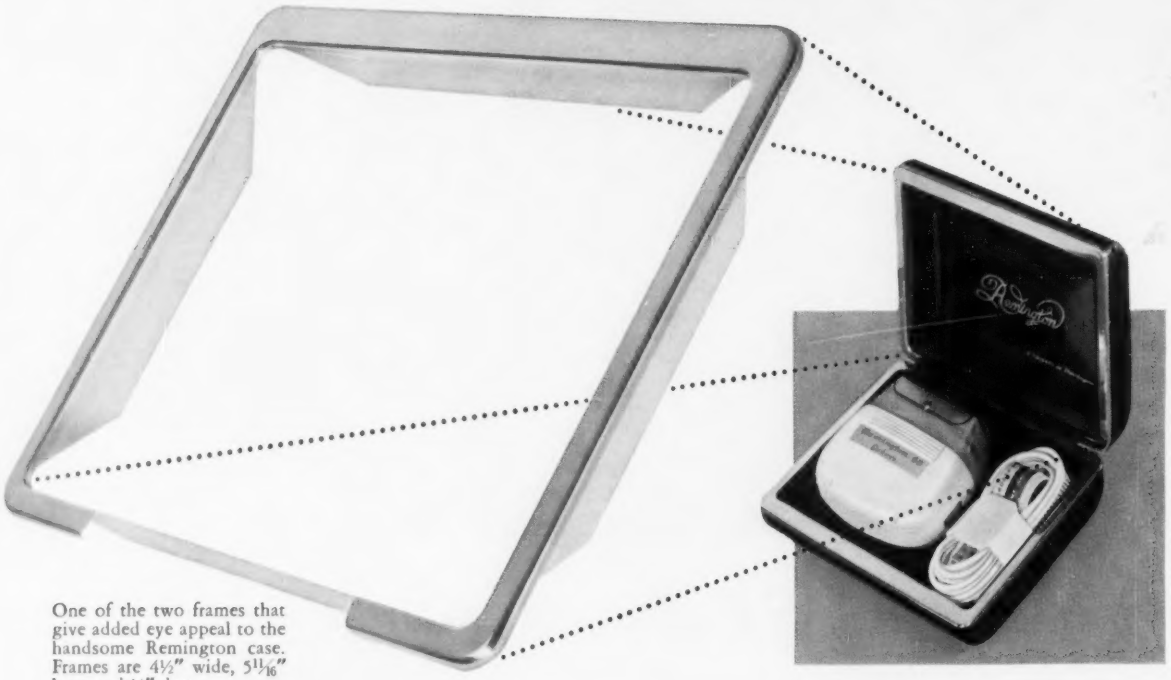
4 Each 19″ shadow mask has more than 400,000 holes, size .010±.0005. Several areas of screen are inspected electronically to check hole size.

ANACONDA the name to remember in

COPPER • BRASS • BRONZE

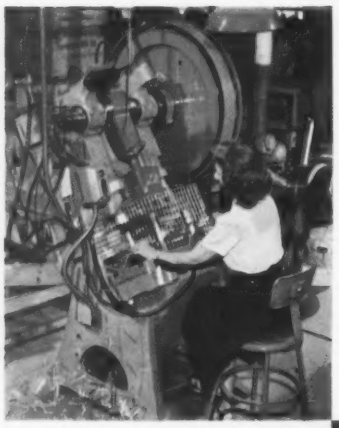
Rejects dropped from 11% to 1%

when Farrington switched to Formbrite for frames of Remington Shaver case



One of the two frames that give added eye appeal to the handsome Remington case. Frames are 4½" wide, $5\frac{11}{16}$" long and ½" deep.

Formbrite* fine-grain drawing brass is harder, stronger, springier...often polishes in half the time



Each day, thousands of these brass frames for the Remington-60 Deluxe Shaver case are made by Farrington Manufacturing Company of Boston. Using ordinary brass, rejects *after polishing* were running at the rate of 11%.

Then Farrington switched to Formbrite. Rejects dropped immediately to less than 1% . . . and with far less polishing Farrington now gets the best finish they've ever seen. And that's important because the Remington case helps sell the shaver.

You'll find Formbrite surprisingly ductile . . . it's readily stamped, formed, drawn and embossed. Yet with all its advantages, it costs no more than ordinary drawing brass. We'd like you to know this cost-saving metal better. May we send you descriptive literature (ask for booklet B-39)? A free sample to try in your own shop? Or have a representative call? Simply write to *The American Brass Company, General Offices, Waterbury 20, Conn.* In Canada: *Anaconda American Brass Ltd., New Toronto, Ontario.*

*Reg. U. S. Pat. Off

5577

Press operator blanks frames for the Remington case out of 6" x .0126" Formbrite drawing brass strip.

Frames are set in fixture for finishing operation on this automatic, three-station polishing machine. Bright, lustrous finish is obtained in one pass through the machine.

Formbrite

FINE-GRAIN DRAWING BRASS

AN ANACONDA® PRODUCT

made by The American Brass Company

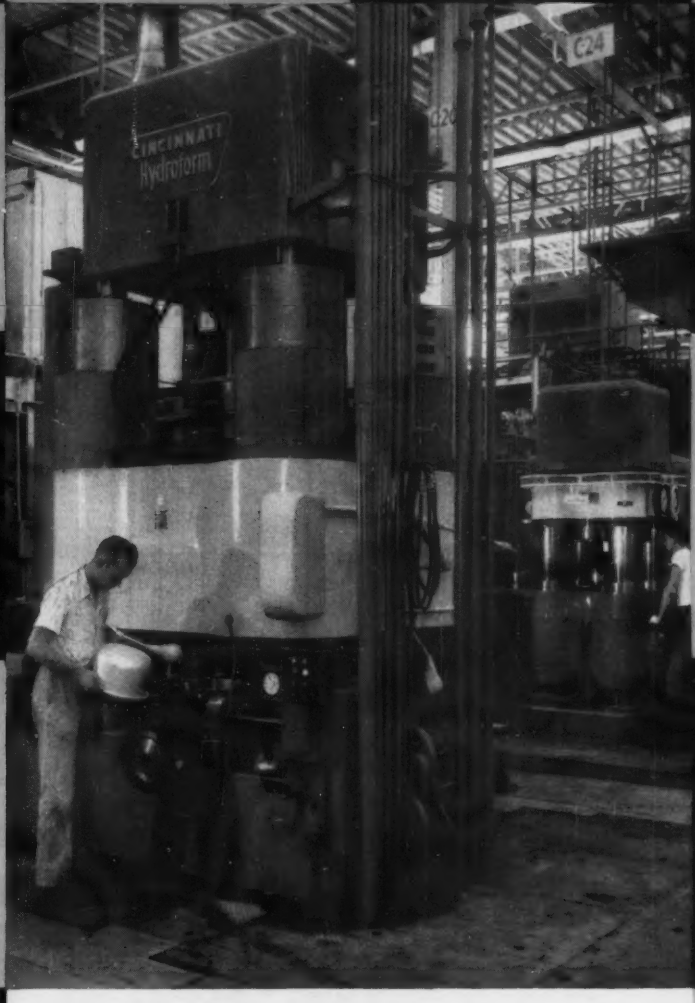
One operation
0.064" 24SO Aluminum

One operation
0.051" 24SO Aluminum

One operation
0.064" 61SO Aluminum

Drop Hammer combined with one Hydroform operation.
0.064" 61SO Aluminum

One operation
0.040" 75SO Aluminum



One operation
0.025" RC70 Titanium

One operation
0.051" 61SO Aluminum

◀CINCINNATI HYDROFORM MACHINES AT NORTH AMERICAN AVIATION, Inc. 26" machine in foreground, 12" machine in background. For a description of the Hydroforming process and specifications of the 8", 12", 19", 23", 26", and 32" machine sizes, write for Bulletin M-1759-3.

Two operations
0.040" 61SO Aluminum

Two operations
0.032" 52SO Aluminum

Three operations
0.032" 61SO Aluminum

These are typical aircraft components produced on two *Cincinnati Hydroform* machines at North American Aviation, Inc. Hydroforming has increased their overall production of intricately-shaped parts . . . made from all types of materials ranging from aluminum to titanium . . . at *very substantial savings* in development and production time, in tooling, material and labor costs.

To determine if Hydroforming can produce similar savings for your manufacturing program, call a Cincinnati Milling field engineer.

CINCINNATI

Hydroform

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.

One operation
0.064" 61SO Aluminum

"Operations Kingsbury" in custom-built indexing machines

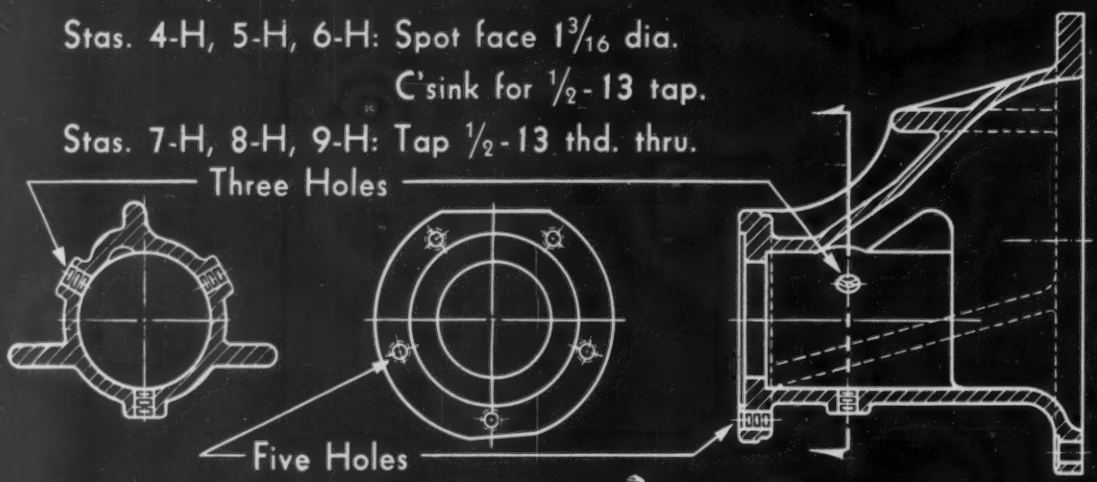
MALLEABLE IRON DIFFERENTIAL CARRIER

240 pieces per hour gross. 24 operations. 8¢ per piece.

Stas. 1-H, 2-H, 3-H: Drill .421 holes.

Stas. 4-H, 5-H, 6-H: Spot face $1\frac{3}{16}$ dia.
C'sink for $\frac{1}{2}$-13 tap.

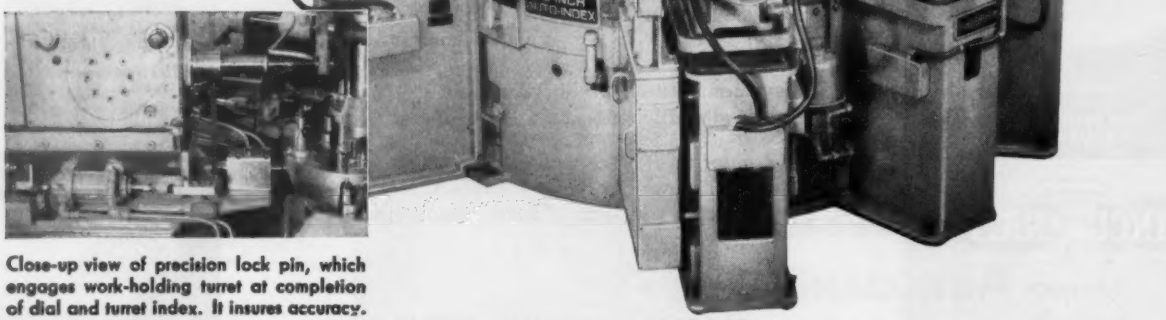
Stas. 7-H, 8-H, 9-H: Tap $\frac{1}{2}$-13 thd. thru.



Sta. 7-V Spotdrill for $\frac{7}{16}$-20 tap.

Sta. 8-V Drill .391 thru.

Sta. 9-V Tap $\frac{7}{16}$-20 thd. thru.



Close-up view of precision lock pin, which engages work-holding turret at completion of dial and turret index. It insures accuracy.

can mean uniform parts at low cost for you

The Malleable Iron Differential Carrier (at left) calls for eight tapped holes. The five vertical holes require three operations, and present no special problem. But . . . the three horizontal holes also require three operations each — and these holes are spaced 120° apart.

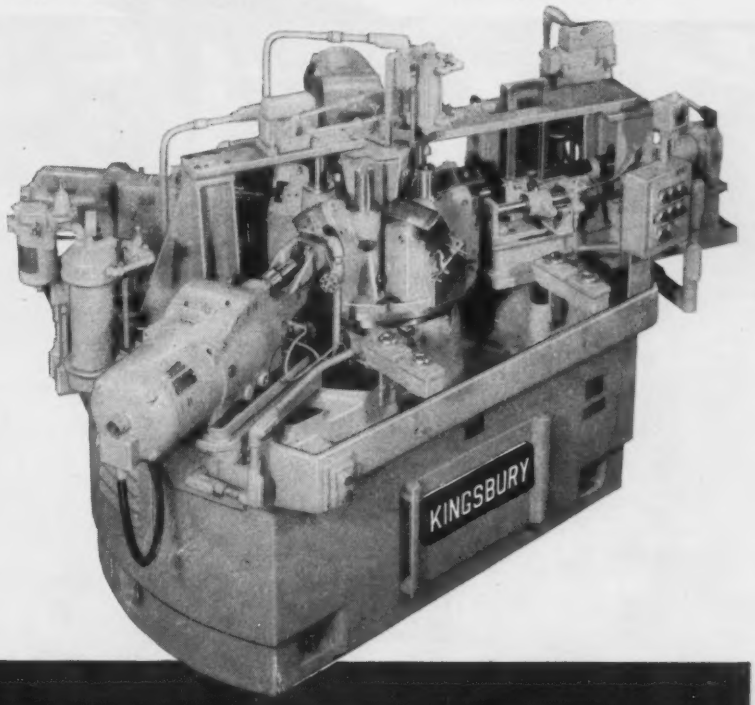
A central column machine is used. It has a 60-inch index table with ten stations (one for loading and unloading). Each of the work-holding fixtures is mounted on a rotating turret which turns 120° as the table indexes. For accuracy, the turret is locked in position as shown in the detail photograph. Work is clamped onto the fixture at each work station.

The Cast Iron Manifold Heat Control Assembly (below) calls for precision machining *and an assembly operation*. This work is *all* accomplished in one production cycle on machine illustrated. The table indexes through five stations (one for loading and unloading). Operations are performed by four horizontal units. At Stations 1, 2 and 3 the hole is drilled, countersunk and reamed. At Station 4 the pins (fed into a chute and released by an escape mechanism) are pressed into the prepared hole by a specially-designed hydraulic ram.

Machines *designed and built* by Kingsbury use work-tested Kingsbury units such as heads, index mechanisms, cutting tool guides, synchronized controls, bases, etc. *But the work-holding fixtures are special — designed for each part.* They have to be, for unless the part can be located correctly and held firmly, required *accuracy* cannot be obtained. And unless the fixtures can be loaded and unloaded quickly and easily, *production* will suffer.

It's a job that requires specialized skills and experience. *We have both.*

Kingsbury Machine Tool Corp.
110 Laurel Street
Keene, New Hampshire

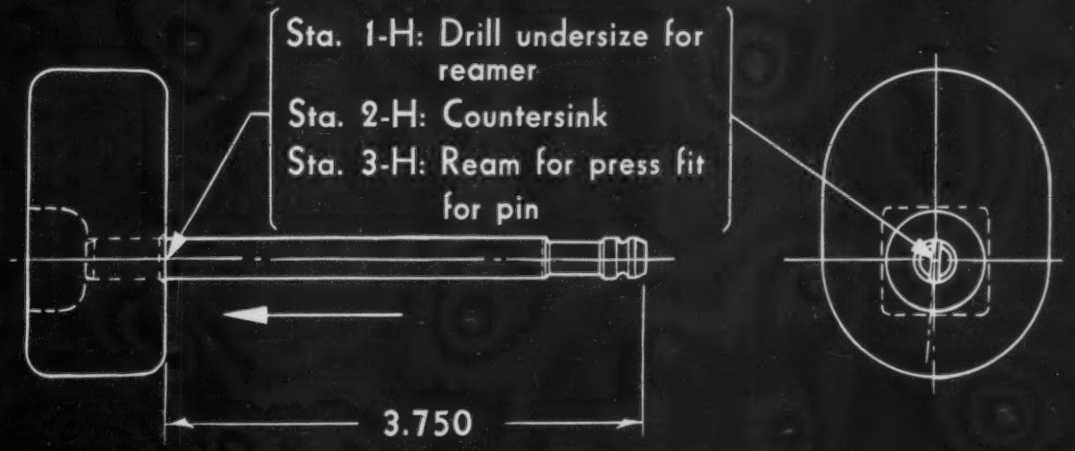


KINGSBURY

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

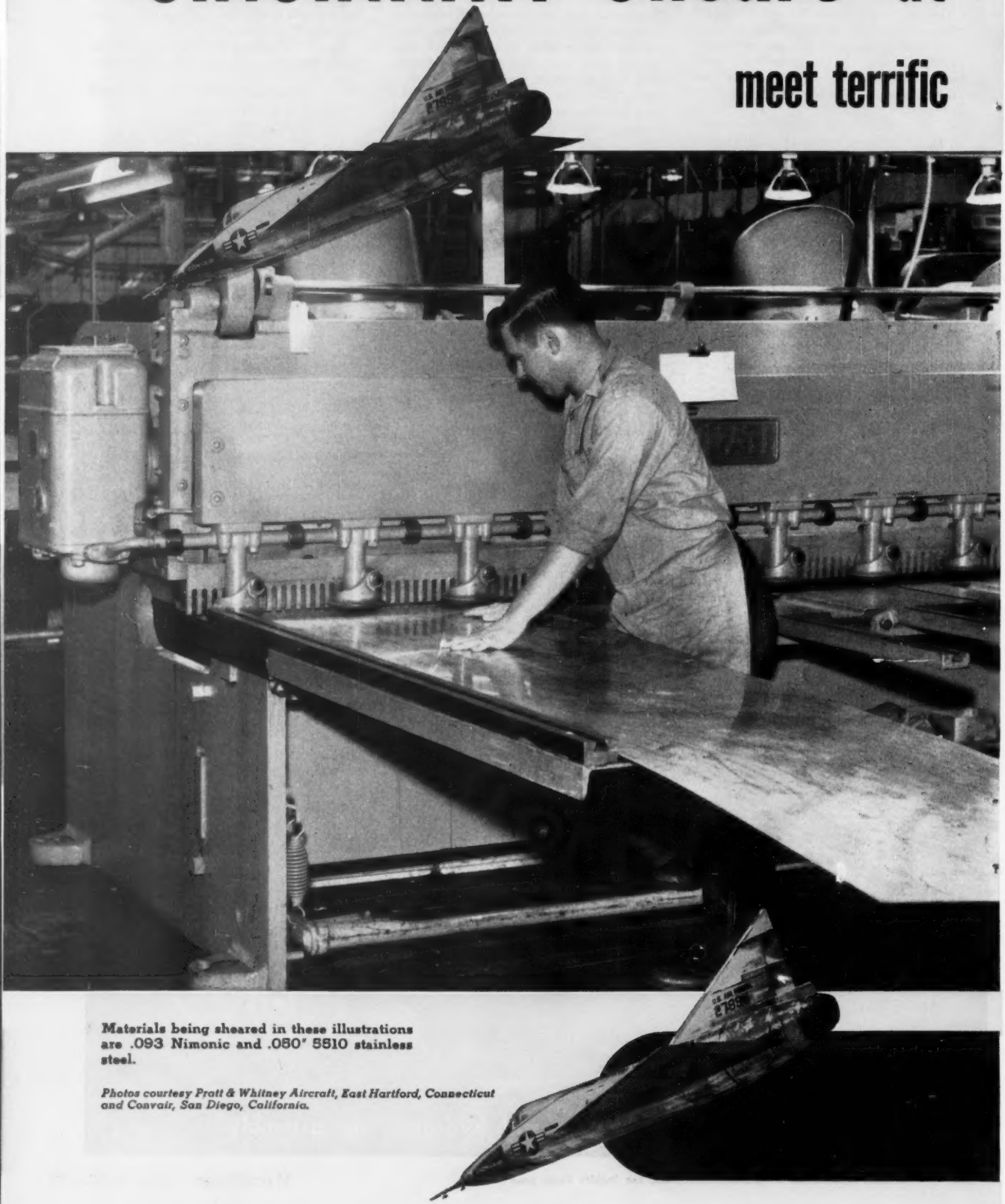
CAST IRON MANIFOLD HEAT CONTROL ASSEMBLY

300 pieces per hour gross. Four operations. $2\frac{2}{10}$¢ per part.



Sta. 4-H. Press pin in place with hydraulic ram assembly.

CINCINNATI Shears at meet terrific



Materials being sheared in these illustrations are .093 Nimonic and .050" 5510 stainless steel.

Photos courtesy Pratt & Whitney Aircraft, East Hartford, Connecticut and Convair, San Diego, California.

PRATT & WHITNEY AIRCRAFT

demand for jet aircraft engines . . .

The right tools for the job were needed at Pratt & Whitney Aircraft, in their tremendous expansion, in the production of the highest power turbojets.

Cincinnati Shears are used in this program. Their accurate performance and ability to shear a wide variety of materials decided their selection.

Investigate:

- Cincinnati "Single Clearance" shearing
- Cincinnati Hydraulic Holddowns
- Cincinnati All-Steel Interlocked Construction

Write for complete Shear Catalogue S-6.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

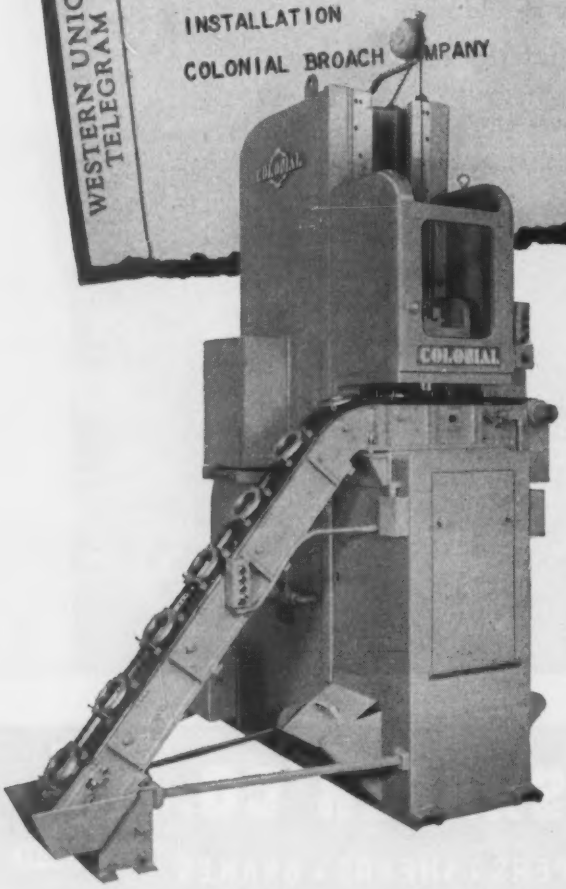
CINCINNATI

WESTERN UNION TELEGRAM

CMC 6 WUX MARCH 9 1955 2:05PM

EVERY 12 SECONDS INSIDE DIAMETER ON A DIFFERENTIAL RING GEAR IS BROACHED TO CLOSE LIMITS ON THIS AUTOMATED SETUP 100 PER CENT EFFICIENCY GIVES A PRODUCTION OF 300 PER HOUR OPERATOR LOADS CONVEYOR FROM FLOOR WITH FOUR STATIONS IN EASY REACH GRAVITY UNLOADS BROACHED RING GEAR BLANKS REPEATING 12 SECOND CYCLE IS (1) PULL-UP WORK STROKE (2) INDEX TO RETURN POSITION (3) RETURN STROKE (4) INDEX TO BROACHING POSITION CONTROLS ARE COMPLETELY SAFETY INTERLOCKED REQUEST BULLETIN RU-54 FOR SPECIFICATIONS ON STANDARD 15-TON 48-INCH STROKE COLONIAL PULL-UP MACHINE IN THIS UNIFIED BROACHING INSTALLATION

COLONIAL BROACH MPANY



every 12 seconds!

PIONEERS OF H.S.S. BROACHING
COLONIAL
BROACH CO. DETROIT 13

UNIFIED BROACHING is the key to successful broaching

For more information on products advertised, use Inquiry Card, page 277

EXTRA VALUE..FROM GASOLINE TO SUN'S METALWORKING OILS

Sun Oil Company makes over 400 petroleum products ...refines better value into every one of them

Sun puts the same extra value into its metalworking oils that it puts into famous Blue Sunoco—Premium Performance at Regular Price.

EXAMPLE: About ten years ago Sun became aware of a hidden source of trouble in metalworking... inadequate lubrication of the ways which support the tables or carriages during a machining operation. The costly result of this inadequate lubrication is called "stick-slip" or jumpy table. This stick... slip...stick (or jump) is often less than a thousandth of an inch...hard to detect and yet enough to cause poor finish, rejects, reduced tool life and a fall-off in production.

SOLUTION: Sun developed its now famous Sunoco Way Lubricant—a product so outstanding in its ability to overcome "stick-slip" that today, more than ten years later, it still is the standard of the metalworking industry.

RESULT: The extra value of Sunoco Way Lubricant has been proved so conclusively that it is approved by more than 55 of the country's leading machine tool manufacturers.

For EXTRA VALUE in petroleum products... buy Sun!

Please turn to the next page

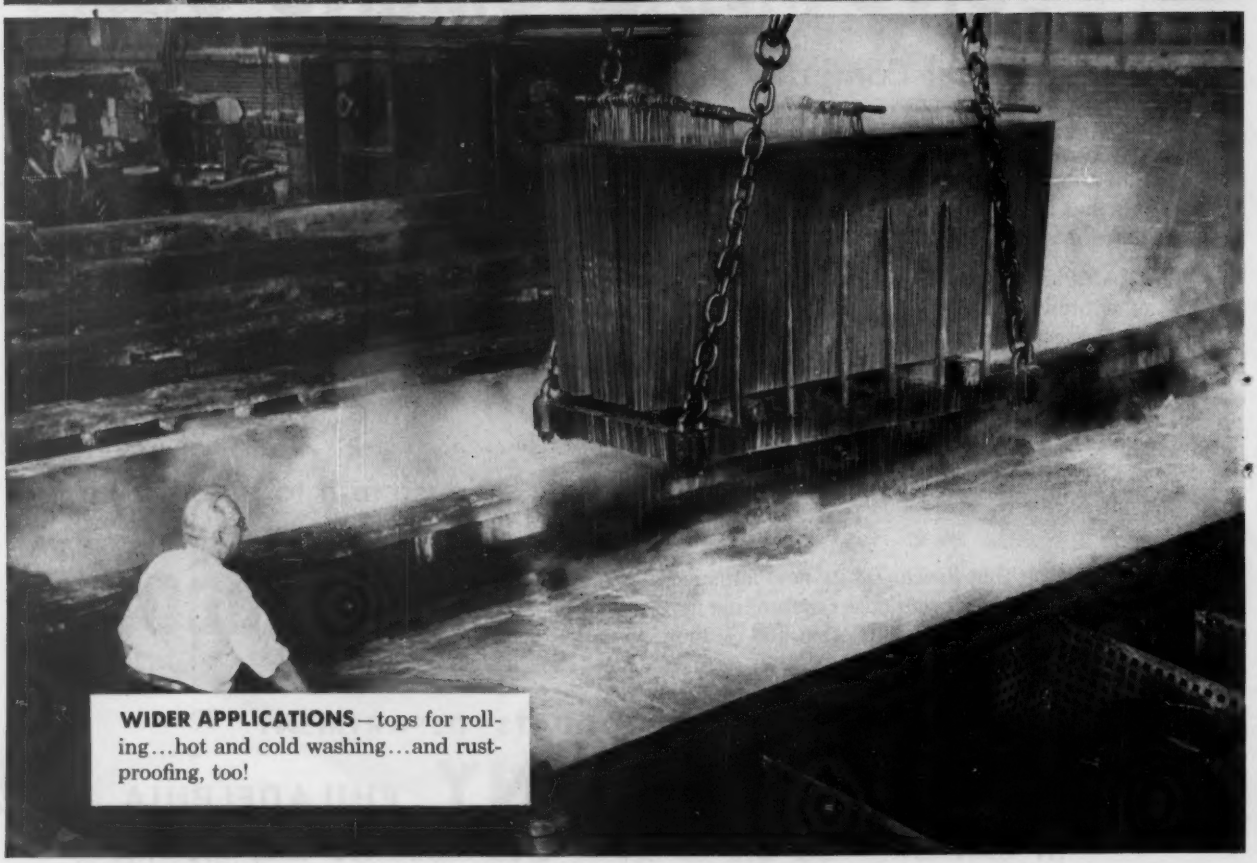
SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

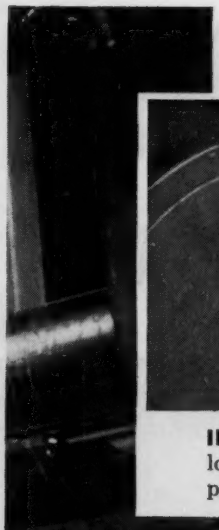
SUN OIL COMPANY PHILADELPHIA 3, PA.

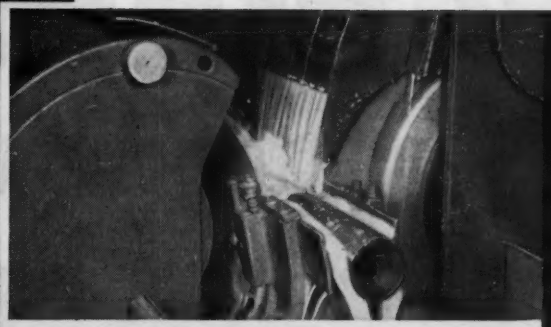
IN CANADA: SUN OIL COMPANY LTD., TORONTO AND MONTREAL

GREATER COOLING POWER—better finishes...tools last longer...production costs reduced.



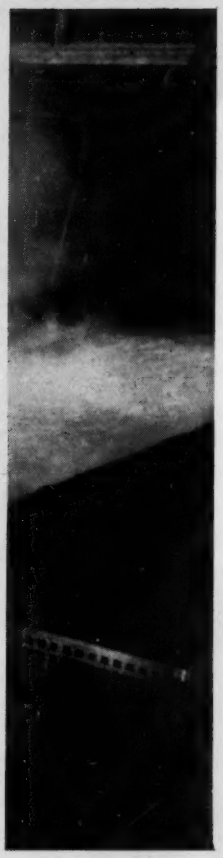
WIDER APPLICATIONS—tops for rolling...hot and cold washing...and rust-proofing, too!





INCREASED DETERGENCY—prevents loading and glazing of grinding wheels, prolongs wheel life.

NEW S.E.C.O.—pours and mixes easily... has better operator acceptance... keeps parts and machines cleaner.



Industry's most widely used soluble cutting oil continues to give highest machining efficiency

OVER 100 MILLION GALLONS OF S.E.C.O. EMULSIONS USED IN '54

The reasons? Simple.
Primarily, industry has faith in Sunoco Emulsifying Cutting Oil. Its high machining efficiency has proven itself over a period of years. S.E.C.O. is the original 100% petroleum emulsifying cutting oil. 'Way back in 1916, machinists started using S.E.C.O.

Constantly improving in quality over the years, S.E.C.O. is now better than ever. During 1954 new refining facilities once more improved industry's most widely used cutting oil... gave users even higher machining efficiency ...better finishes...longer tool life... increased production.

Test the new S.E.C.O. in your own plant. Notice how its high detergency and purity keeps tools, parts and machines clean...how easily it mixes in hot, cold or hard water. Notice, too, how S.E.C.O. cuts operating costs... improves rolling operations, hot and cold washing, and rustproofing.

See for yourself why Sun's S.E.C.O. continues to be the leading emulsifying cutting oil in the country today. For information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-6.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

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IN CANADA: SUN OIL COMPANY LTD., TORONTO AND MONTREAL

NIAGARA 2 POINT tomorrow's

Niagara Series BI Gap Frame,
Double Crank Inclinable Press.

INCLINABLES
design for today's production needs*

From crown to base . . . *taking in every part and operating feature* . . . the Niagara Double Crank Inclinable Press Series stands alone in advanced engineering. By record and by reputation, this is the press with the best future for cost-cutting, production-boosting, *long die area work.*

*** LONGER LIFE FOR LONG DIES**

Niagara's double crank design resists tilting of the slide under off-center loading, thereby reducing misalignment of dies. Rugged, welded steel plate, box type slide rigidly supports punches. Heavy duty, rigid, integrally built frame properly resists deflection, maintaining permanent alignment of bearings and slide.

FASTER WORK HANDLING

Die area is accessible from *all* sides. Work may be fed from either side or front-to-back with equal facility, and is quickly discharged by gravity through the unobstructed opening in the back when the press is inclined . . . *yes, even long work!*

GREATER VERSATILITY

A tremendous variety of blanking, perforating, forming and drawing operations can be performed, with emphasis on work requiring long die areas. All presses in the series are designed to readily accommodate pneumatic die cushions which Niagara furnishes complete with accessories and fittings.

HIGHER PRODUCTION RATE

Optionally equipped with automatic feeds and variable speed drives, Niagara 2-Point Inclinables are well suited to large quantity production and long, continuous runs.

MORE ECONOMICAL MAINTENANCE

Features that spell *stamina* and *ruggedness* . . . welded steel plate frames with box section crowns and deep beds forming rigid ties between uprights; welded steel plate, box type slides; precision "V"-flat gibs; bronze bushed main bearings; self-aligning ball-seat connections; Niagara electro-pneumatic and mechanical sleeve clutches . . . all combine to keep maintenance at a practical minimum.

• • •

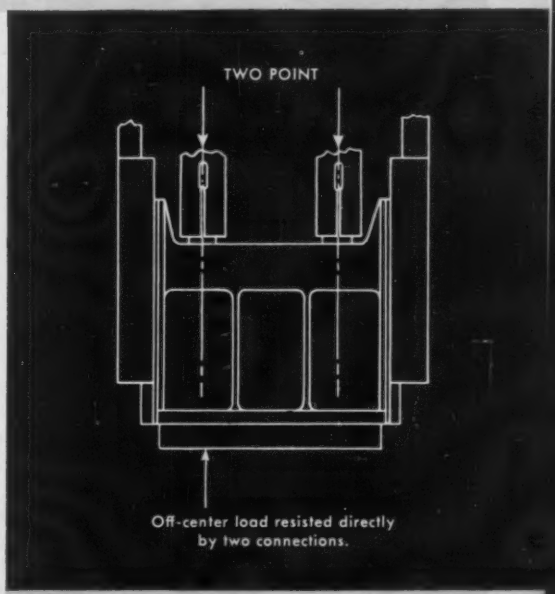
Standardized in capacities from 65 thru 222 tons, Niagara Series BI Double Crank Inclinable Presses are your most logical answer to long die area work. For still longer requirements, Niagara builds a complete line of permanently inclined or upright Series B Presses.

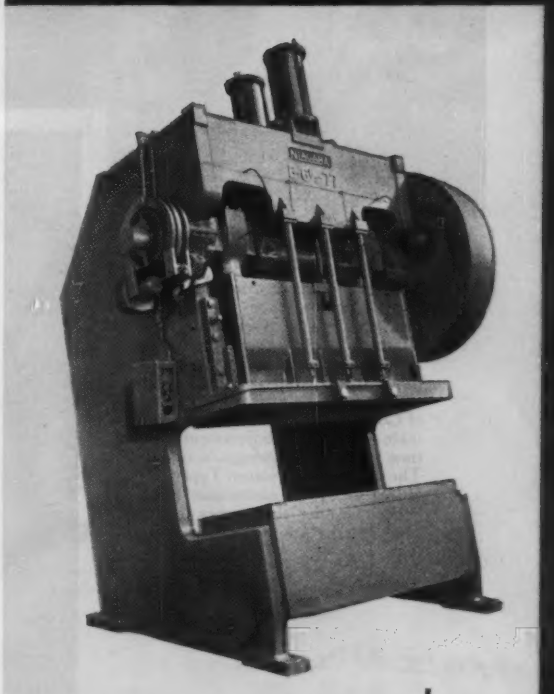
Obtain complete details on *all* the noteworthy Niagara features by requesting Bulletin 65. Consult with a Niagara engineer about *your* problems.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

Dealers in principal U. S. cities and major foreign countries

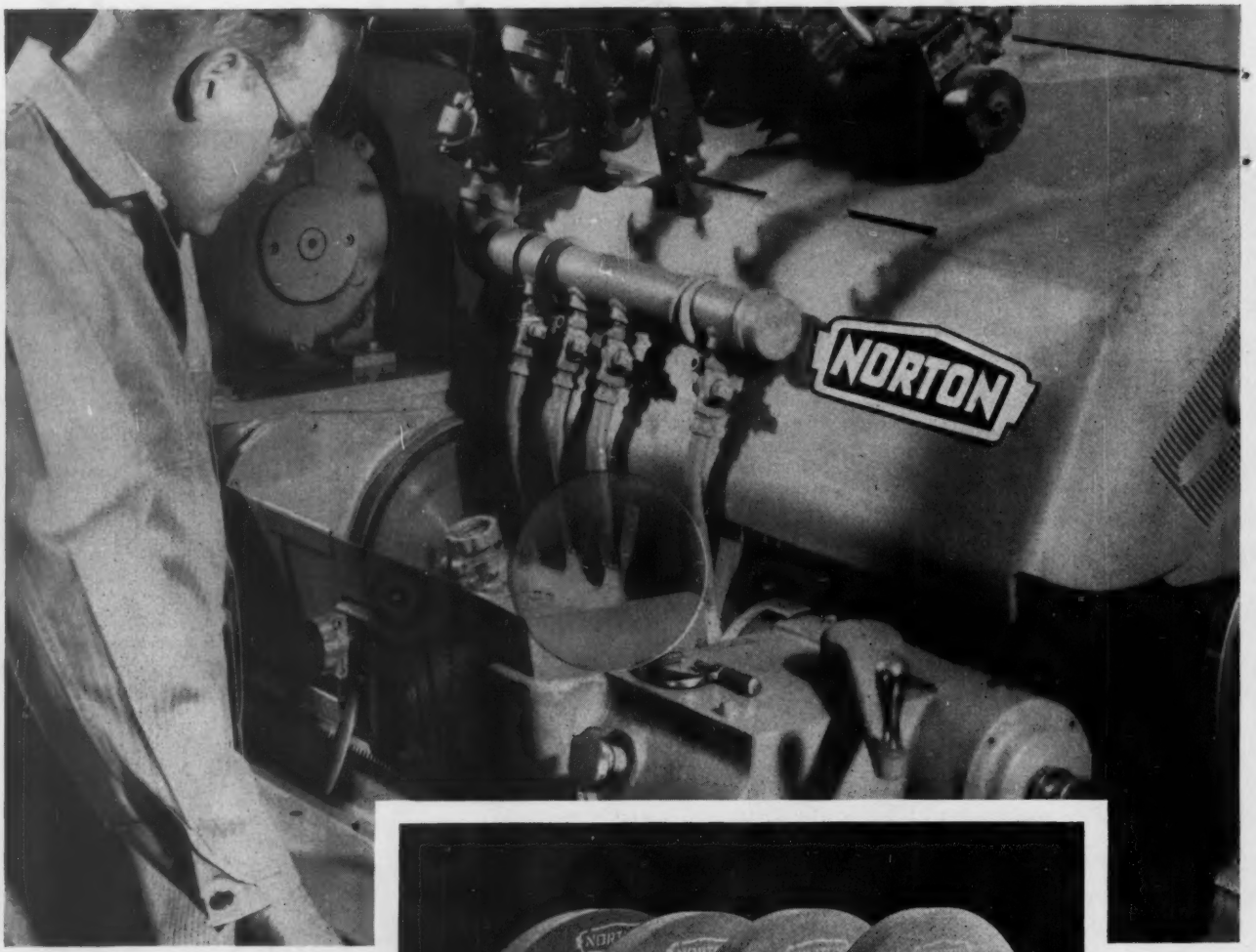


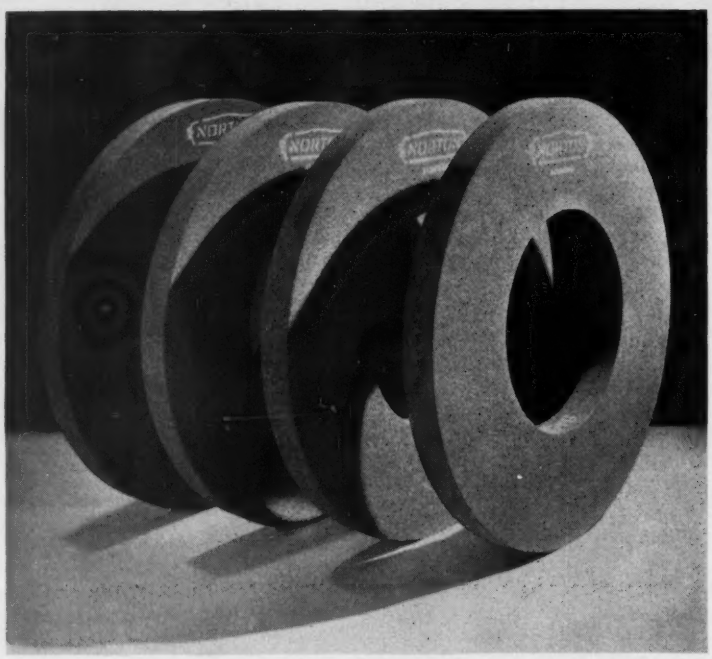


Niagara permanently inclined, gap frame, double crank press.

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

NOW...





Top Performance Multiplied By Four. Grinding four diameters at once, four new Norton G Bond ALUNDUM® wheels are delivering identical precision performance, cutting fast, free and cool and wearing at the same uniform rate. "Touch of Gold" advantages like these eliminate fussing with adjustments, save time and money, safeguard quality. The machine is a Norton Type CM-1 Heavy Duty Semiautomatic Multi-Wheel Grinder that makes four *or more* cuts in a single plunge-grind cycle.

New Norton G Bond Wheels

insure uniform, multi-wheel grinding... one of many "TOUCH of GOLD" advantages

You know what happens when even one wheel in a multi-wheel grinding setup wears slower or faster than the rest. At best, it requires constant watching and adjusting. At worst, it can cause costly delays, and might even spoil the work.

You can get rid of these particular threats to your production, once and for all. Built by Norton's exclusive precision-processing, the new G Bond wheels are really uniform in structure, within each wheel and from wheel to wheel. That's why you can count on identically marked G Bond wheels for identical performance — one of the most valuable benefits you can bring to any multi-wheel grinding job.

Added to this, the new Norton G Bond, designed for precision and semi-precision grinding, is the most radically improved vitrified bond ever developed. Holding each abrasive grain just long enough for maximum cutting action, it assures a constant grinding surface of fresh, sharp cutting edges. As a result, the success of G Bond wheels has been truly sensational, and their reputation for outperforming and outlasting ordinary wheels is growing every day.

Remember: when you standardize on G Bond wheels the product-improving, cost-cutting "Touch of Gold" performance that is built into *each single wheel* is duplicated by *every other wheel* in a setup.

G Bond wheels bring you these big advantages

Matchless uniformity • Do more work per wheel
Dress easier — more pieces per dressing
Hold shape — better for form grinding
Hold corners better

Your Norton Distributor

has the types and sizes of G Bond ALUNDUM wheels you need for single or multi-wheel grinding. Ask him about arranging a test in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

Making better products... to make other products better

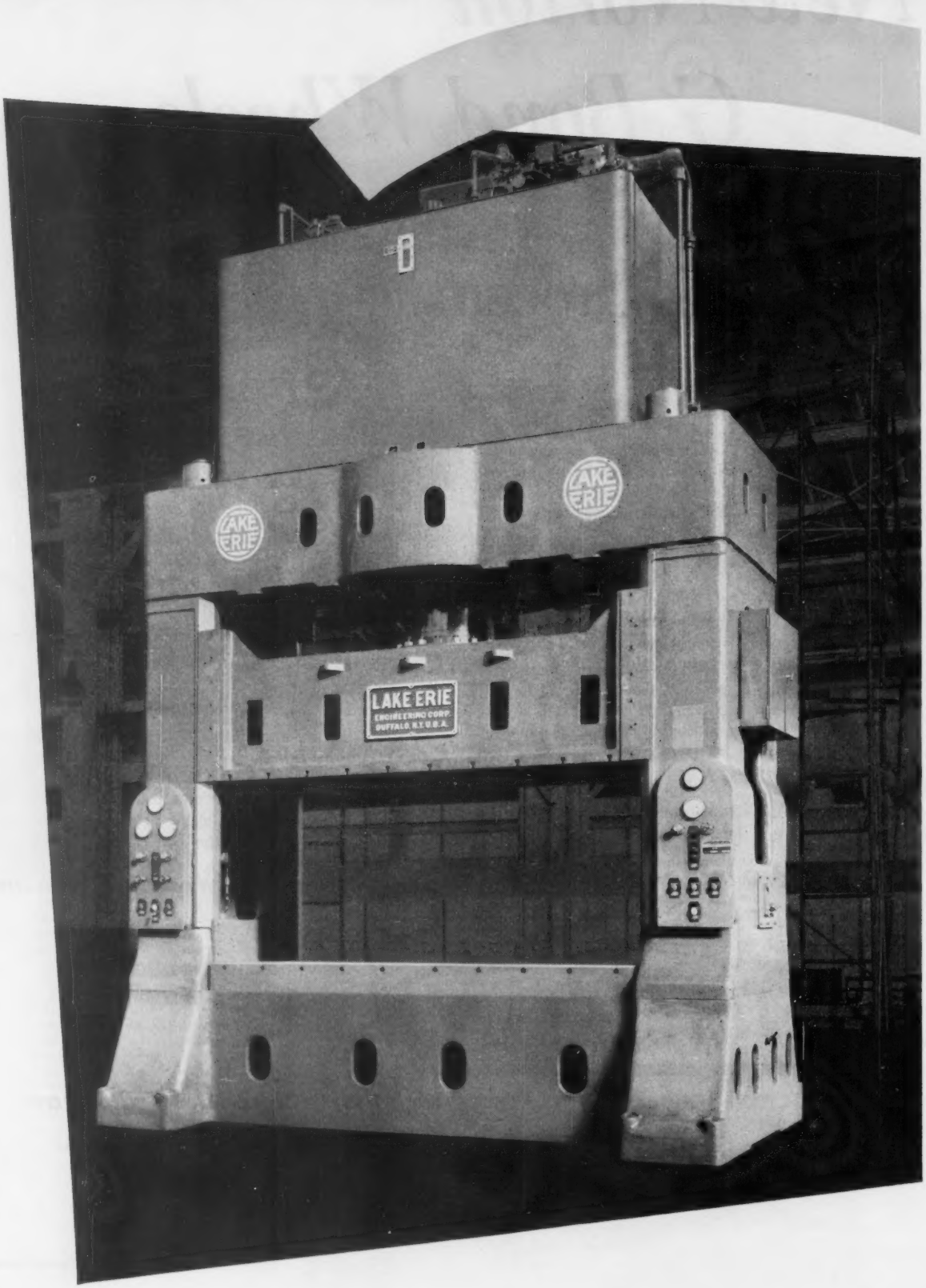
NORTON

and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

DESIGN POLICY IS THE



KEY TO SUPERIOR PRESSES

FORGED STEEL CYLINDERS... *eliminate possible failure of integrally cast cylinders*

HEAVIER SECTIONS... *mean lower stresses.*

LAPPED CYLINDERS AND PISTONS... *insures precision fit.*

QUICK-SET STROKE CONTROLS... *save time on set-ups.*

UNUSUALLY RUGGED SIDE HOUSINGS... *increase frame rigidity.*

FAIL-SAFE DEVICES... *in electric and hydraulic circuits.*

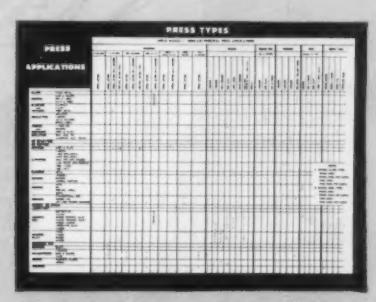
SIMPLIFIED ELECTRICAL SYSTEM... *designed for maximum safety and ease of maintenance.*

BRONZE USED EXTENSIVELY... *bronze throat bushings provide better guiding.*

... *bronze piston heads, gland bushings, and pre-fill valve disc prevent scoring.*

LAKE ERIE BUILDS THEM BETTER... Mechanically, electrically, and hydraulically, Lake Erie presses bring you the greatest number of superior features. That's why Lake Erie press users almost always return to us for additional presses. They know from experience that Lake Erie incorporates many "special" features as "standard"... features which seldom if ever form a part of customer specifications. They know that these features mean longer press life, minimum maintenance, maximum productivity. Next time, call on Lake Erie.

SEND FOR HANDY BUYER'S GUIDE



LAKE ERIE HYDRAULIC PRESSES

EXTRUSION PRESSES • DIE CASTING MACHINES
ROLLING MILL AUXILIARY EQUIPMENT

LAKE ERIE ENGINEERING CORP. *General Offices and Plant: 470 Woodward Ave., Buffalo 17, N. Y.*
District Offices in New York, Chicago, Detroit, Pittsburgh
Representatives in Other U. S. Cities and Foreign Countries

LAKE ERIE®

Why fish around...

WHEN IT COMES TO SHALLOW HOLES

SHALLOW DIAMETER GAGE
12 inches and up

Here's a Gage To Do The Job!

- Light Weight for Easy Handling
- Maximum Rigidity — Large Tube Construction
- Reversible for Internal and External Applications
- Adjustable for Depths and Diameters
- Positive Three-Point Support
- Measures To or Past Shoulders and Counterbores
- Frictionless Gaging Movement

WRITE FOR CATALOG

STANDARD GAGE COMPANY, INC.
12 PARKER AVENUE
POUGHKEEPSIE, NEW YORK

For more information on products advertised, use Inquiry Card, page 277

see
good investments in action

Barnes Drill Co.

Rehnberg-Jacobson Mfg. Co.

Barber-Colman Company

Rockford Machine Tool Co.

Hendey Machine Division
Barber-Colman Company

Sundstrand Machine Tool Co.

Greenlee Bros. & Co.

American Broach & Machine Company
DIVISION OF
Sundstrand Machine Tool Co.

John S. Barnes Corporation

W. F. & John Barnes Co.

Mattison Machine Works

Visit these Rockford Manufacturers During the Machine Tool Show

Keep gathering metal-working production ideas . . . be well informed when the time for replacement arrives

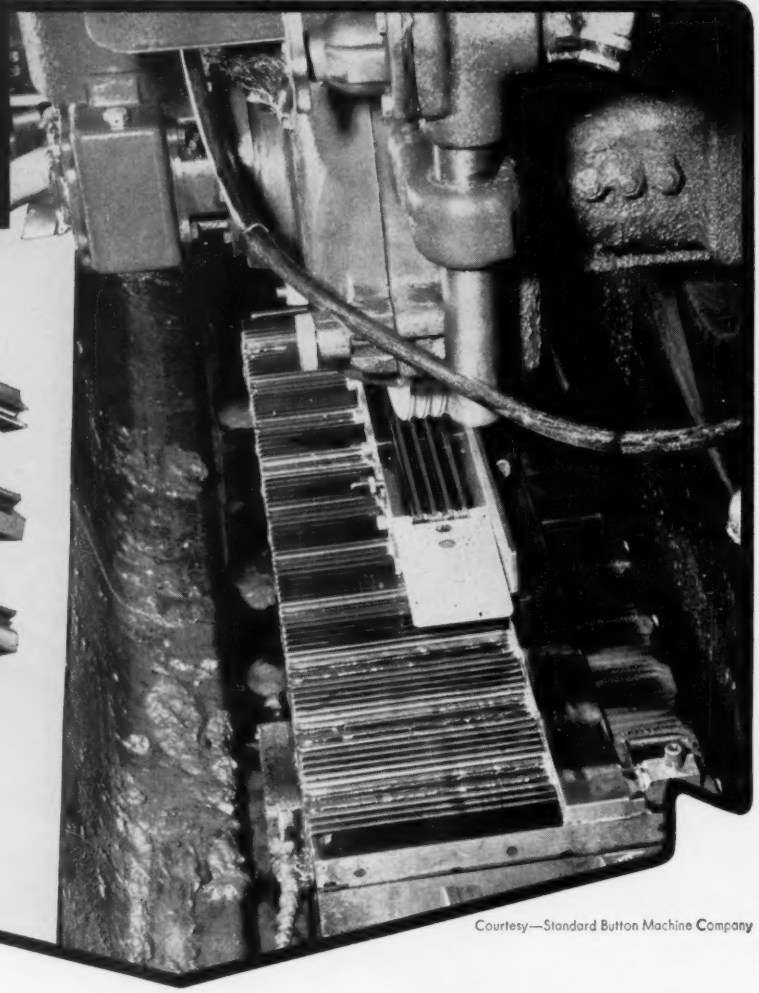
ROCKFORD INSERT GROUP

June, 1955

CASE HISTORY NO. 3—HIGH-SPEED STEEL FACING TOOLS

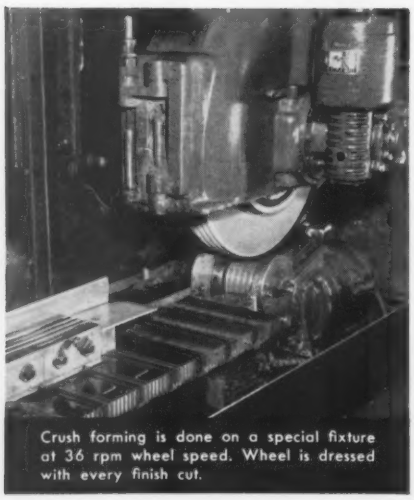
MATTISON
HIGH-POWER
GRINDING METHODS

Tools are M2 High-Speed Steel, hardened to 63 Rockwell, "C." Fine micro finish results, using 220 grit wheel.



Courtesy—Standard Button Machine Company

Crush grinds 36 hardened h.-s. steel facing tools . . . holds .0005" form tolerance!

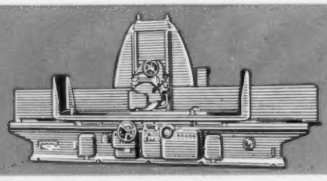


Crush forming is done on a special fixture at 36 rpm wheel speed. Wheel is dressed with every finish cut.

These hardened, high-speed steel facing tools are form ground with ease on the Mattison 12" x 16" x 36" High-Powered Precision Surface Grinder, and held to a machining tolerance of .0005". Jig holds 12 tools across and 3 end-to-end, or 36 per load. Finish, with 220 grit wheel, is between 15 and 20 R.M.S.

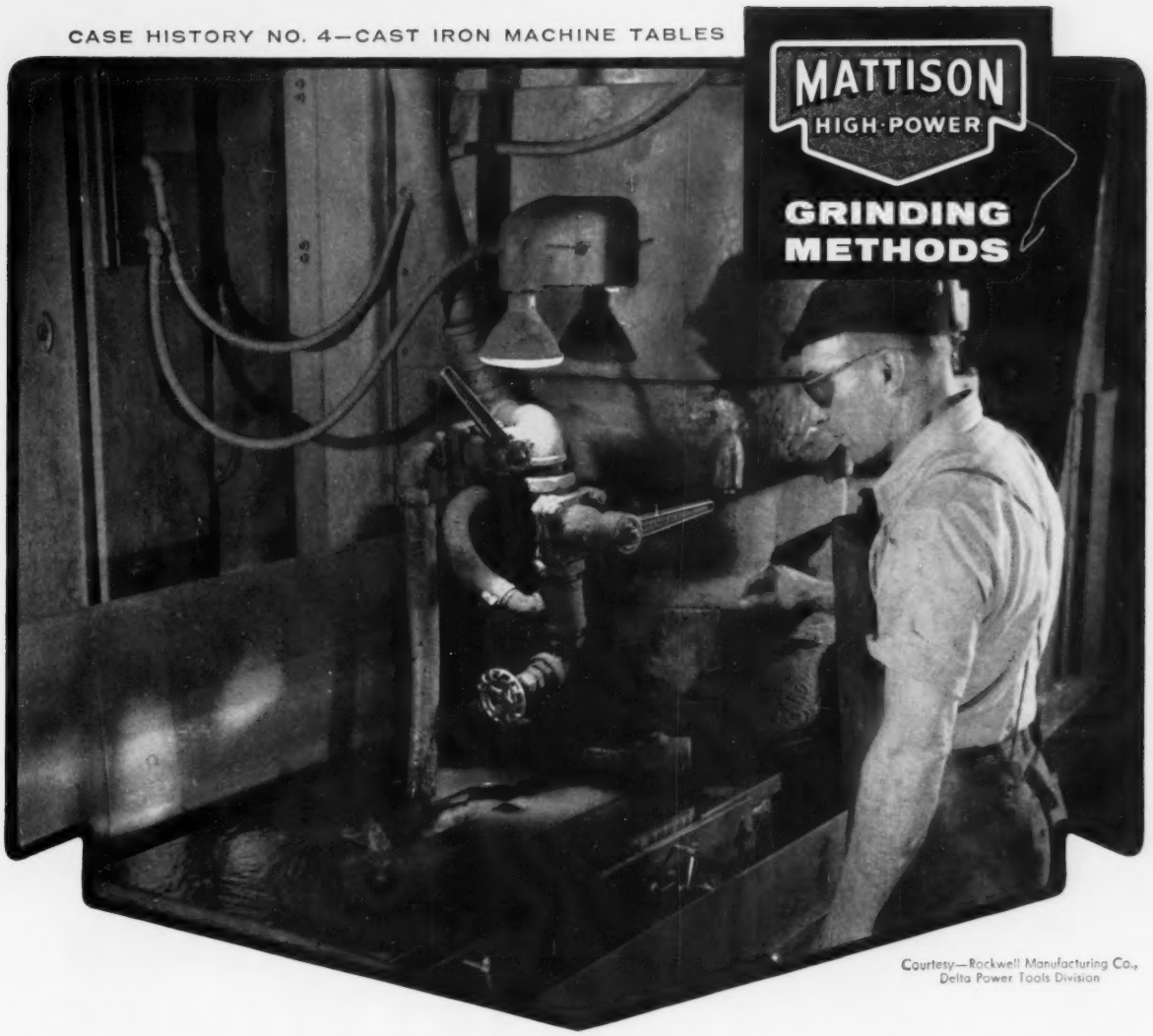
You can cut toolroom, maintenance, *and production* machining costs greatly with a standard Mattison Surface Grinder. Complex parts you may now be broaching, milling, or hand scraping can be shaped more accurately. Stock from rough castings can be removed at maximum speeds without cutter breakage. Tool sharpening and setup problems are eliminated, and you'll be surprised at the number of operations in your shop you can do better, *at lower cost*, on this high-powered, precision machine tool! 40 standard machines, table sizes from 12" x 36" to 36" x 192". Send for Bulletin "HP."

If it's a flat surface, there's a Mattison to grind it!



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

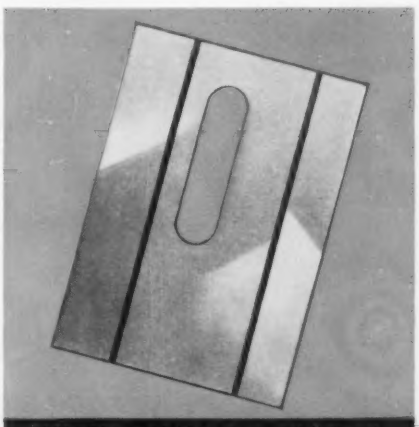
CASE HISTORY NO. 4—CAST IRON MACHINE TABLES



Courtesy—Rockwell Manufacturing Co., Delta Power Tools Division

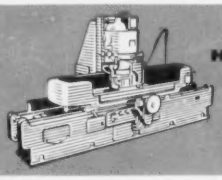
"Cost 60 to 70% lower" . . . finishing large saw tables!

By grinding these cast iron machine tables on the Mattison No. 400SS Vertical Spindle Surface Grinder, production costs are 60 to 70% lower than by other methods. This is because the "400SS" is adequately powered and rigidly constructed for high stock removal when machining large, uninterrupted surfaces. The wheel is constantly self-dressing and free-cutting. There's no heat distortion to destroy finish or accuracy . . . no downtime for sharpening a "loaded" wheel. Removing .060" stock, production is 8 to 12 table tops per hour. Mount pads on bottom side are machined at the rate of 35 to 40 per hour. This profit-boosting efficiency, plus the extra-wide work table and 25" wheel clearance of the "Model 400SS," make this machine a truly low-cost method for machining large, plain surfaces. Send your parts to the Mattison Methods Laboratory for free *sample grind and production estimate.*



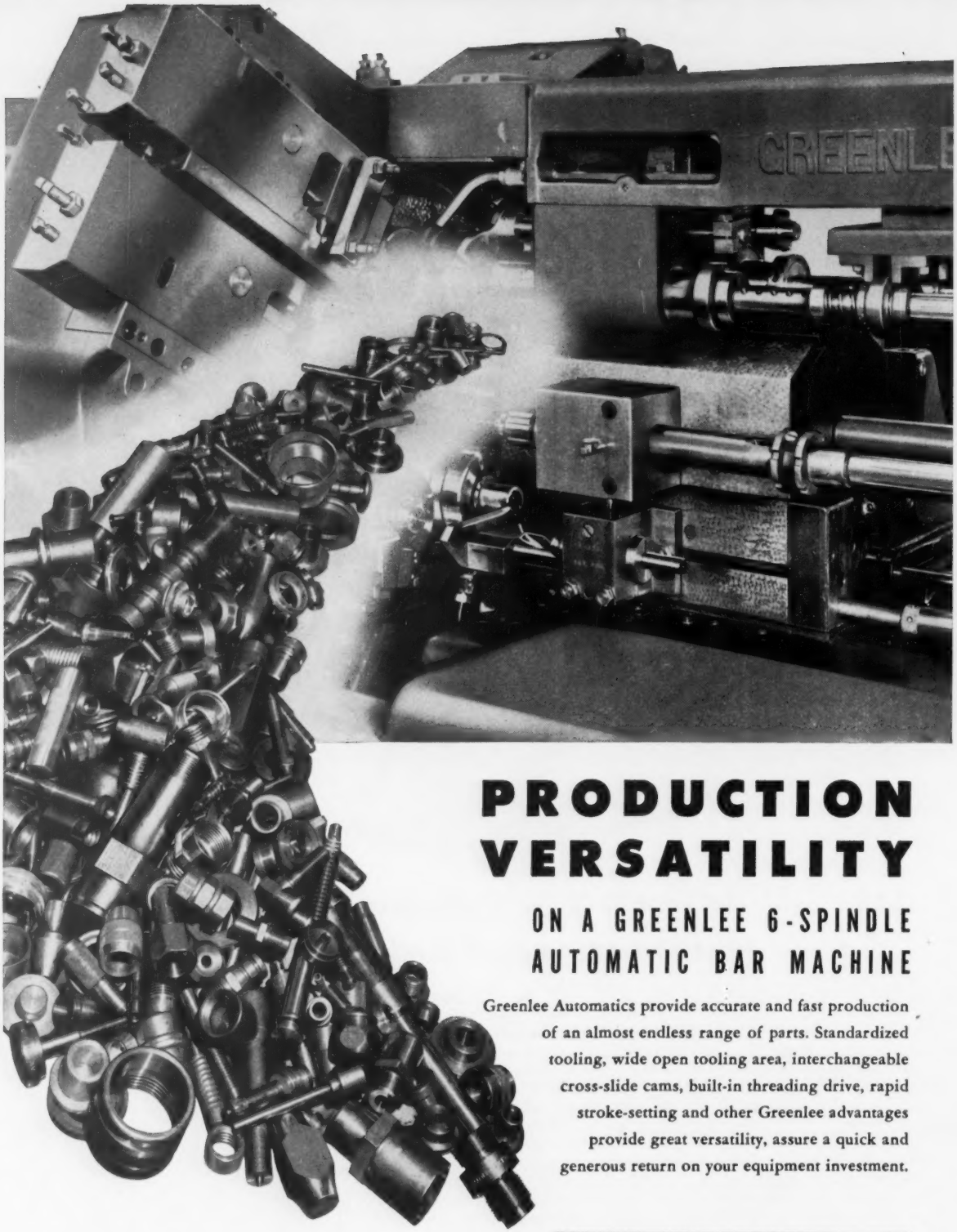
28" wide saw tables are ground flat, and within .005" over entire 38" length, using 32" dia. segment wheel.

MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.



HIGH-POWERED SURFACE GRINDERS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



PRODUCTION VERSATILITY

ON A GREENLEE 6-SPINDLE AUTOMATIC BAR MACHINE

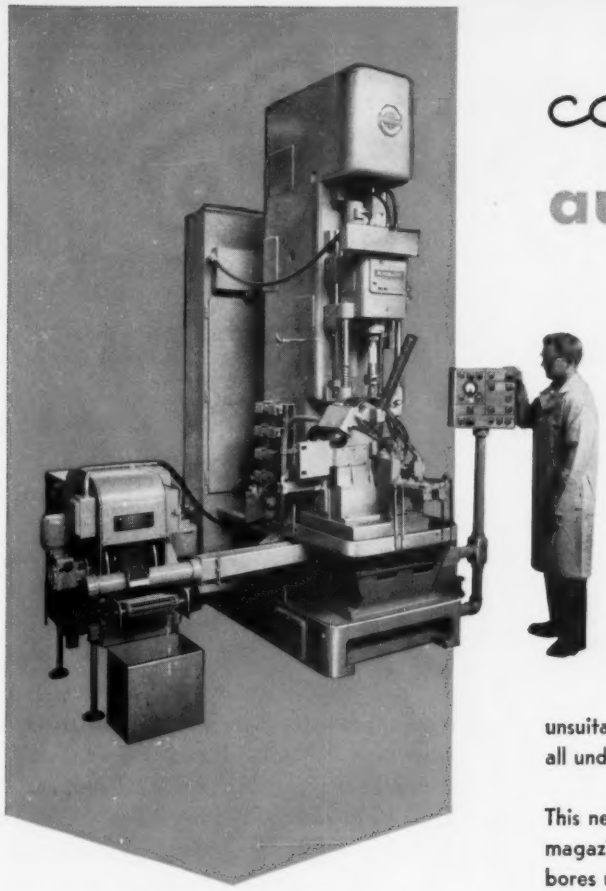
Greenlee Automatics provide accurate and fast production of an almost endless range of parts. Standardized tooling, wide open tooling area, interchangeable cross-slide cams, built-in threading drive, rapid stroke-setting and other Greenlee advantages provide great versatility, assure a quick and generous return on your equipment investment.

PHONE ROCKFORD, ILLINOIS 3-4881
TO HELP SOLVE YOUR PRODUCTION PROBLEMS

PRODUCTION MACHINERY
GREENLEE
G

GREENLEE BROS. & CO.
1866 MASON AVE
ROCKFORD,
ILLINOIS

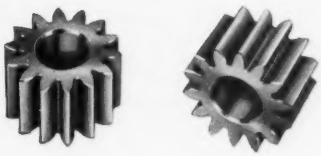
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



completely automatic honing!

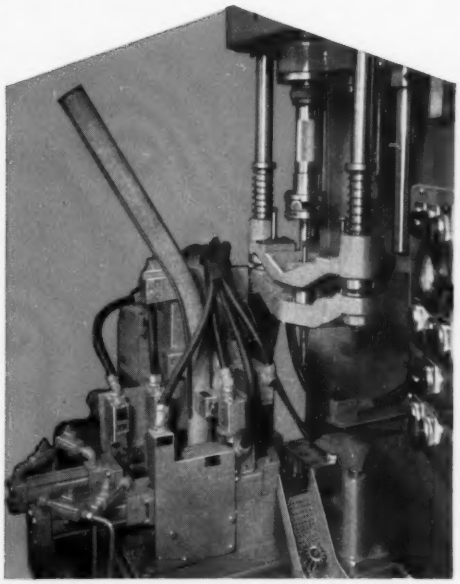
This BARNESDRIL Honing Machine Specially Designed for Continuous Operation with Magazine-Load and Automatic Ejection of Finished Parts.

BarnesdriL engineers have now established bore-finishing operations on a continuous and automatic basis — complete with automatic bore-to-bore sizing, automatic rejection of unsuitable parts, and automatic ejection of finished pieces. — all under Precision control at high production rates.



This new No. 223 BarnesdriL Honing Machine is designed with magazine-feed for loading. It automatically rejects oversize bores unsuited for honing and advances gear to honing position. It hones and sizes to preselected tolerances and finish, and then discharges finished and sized part.

All of these steps are under control of the automatic timed-cycle which successively removes stock, finishes and guarantees precision bore-to-bore sizing. Electronic hone expansion keeps the honing operation always at peak efficiency and automatically compensates for stone wear. Quick-loading type honing stones provide cutting support right up to the cutting edge, for long life and free cutting action.



Performance results in 180 hard steel gears honed per hour at 80% efficiency. Plugmatic sizing holds bore within .0005", and .001"/0015" stock is removed to a finish of 10 RMS.

Why not automate your bore finishing operations in a similar fashion and take advantage of reduced finishing costs through automatic high production and precision control. Call a BarnesdriL engineer, or drop in and talk it over at the Machine Tool Show.

SEE IT IN ACTION BOOTH NO. 818

BARNES DRILL CO.

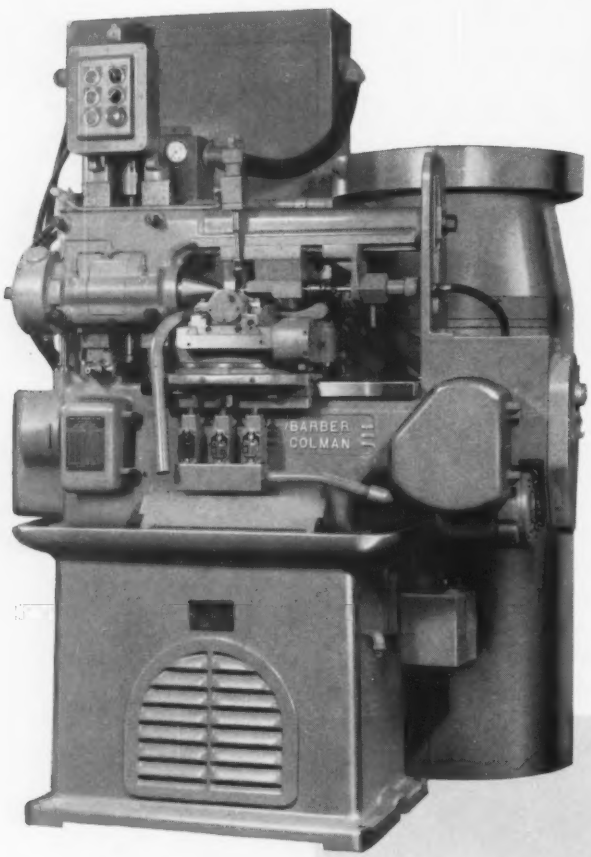
820 Chestnut Street • Rockford, Illinois

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

NEW LOW GEAR COSTS

Gears 16 Pitch or Finer...with

FULLY AUTOMATIC GEAR HOBBING



As more and more gear operations are modernized to place them on a competitive basis, automatic gear hobbing equipment becomes an essential approach in reducing gear costs. Since 1937 Barber-Colman engineers have been working closely with major gear producers in the application of automatic gear hobbing. At first, automatic hobbing applications were made in the watch gear and instrument fields. Later, machines were built for medium pitches in other fields, such as fishing reel gears. The latest Automatic No. 6-10 Hobbing Machines are designed specially for cutting automatic transmission and speedometer gears to meet the required rate of production on an automatic production line.

First Automatic Cycle Hobbing Machine 1936.
First Fully Automatic Hobbing Machine 1937.
Automatic Hob Shifting for Increased Tool Life 1944.

B U I L D E R S O F P R E C I S I O N G E A R

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

HIGH-PRODUCTION PLANT REPORTS SAVINGS IN UNIT-COSTS WITH FEWER GEAR REJECTS

In this particular production plant, fewer gear rejects are occurring. An overall reduction in cost per gear has been effected through reduced man-hours and continuous high-speed output. One of a battery of machines performs as follows:

Automatic Cycle — 356 Hob RPM, .030" feed per rev., 34-second complete cycle time, 1 per load.

Speedometer Gear — 19 teeth, 8°3'22" RH helix angle, 26 DP, .850"OD x 3/8", 25°PA.

Class C Accurate Unground Hob — 2 3/8"OD x 3" face x 3/4" bore, 3-thread, 25°PA, 4200 pieces per sharpening.

COMPLETELY AUTOMATIC CYCLE PROVIDES CONTINUOUS HIGH-SPEED GEAR CUTTING

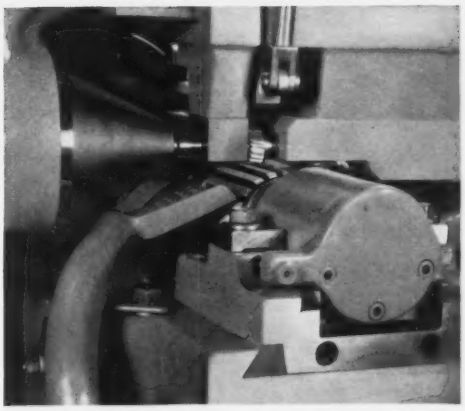
Blanks are automatically loaded through a hopper-feed system and positively located and clamped on a solid arbor in cutting position. The cycle sequence includes rapid traverse to the hobbing position, lowering of the work slide to cutting depth, hobbing the blank, raising the work slide, rapid traverse to the right, and unload. A new blank then is automatically presented for hobbing and the cycle repeated continuously until the machine is shut off. The machine is equipped with an automatic hob shifter which moves the hob to a new cutting position after each cycle.

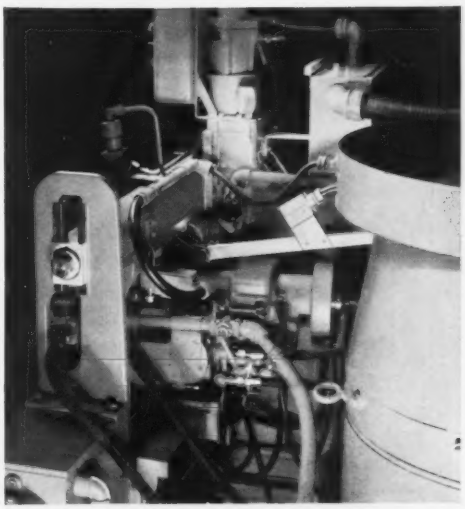
ADAPTABLE TO WIDE RANGE OF LONG-RUN, HIGH SPEED GEAR PRODUCTION

This type of cycle arrangement is adaptable to many similar long-run gear cutting operations within the general range of 16 pitch and finer, depending upon the particular gear specifications. The cycle is arranged to suit the requirements of the job, and tooling, feed, speed and cycle-timing will depend upon the required production and gear specifications.

ENGINEERING SERVICE AVAILABLE WITHOUT OBLIGATION

Check your high production gear operations to determine whether you are maintaining a competitive cost basis. Barber-Colman engineers will gladly consult with your gear production people to demonstrate the cost-saving benefits of automatic hobbing. Ask your Barber-Colman representative to arrange an appointment for you, or write directly to Automatic Hobbing Engineering. No obligation.





HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 626 ROCK STREET, ROCKFORD, ILL.

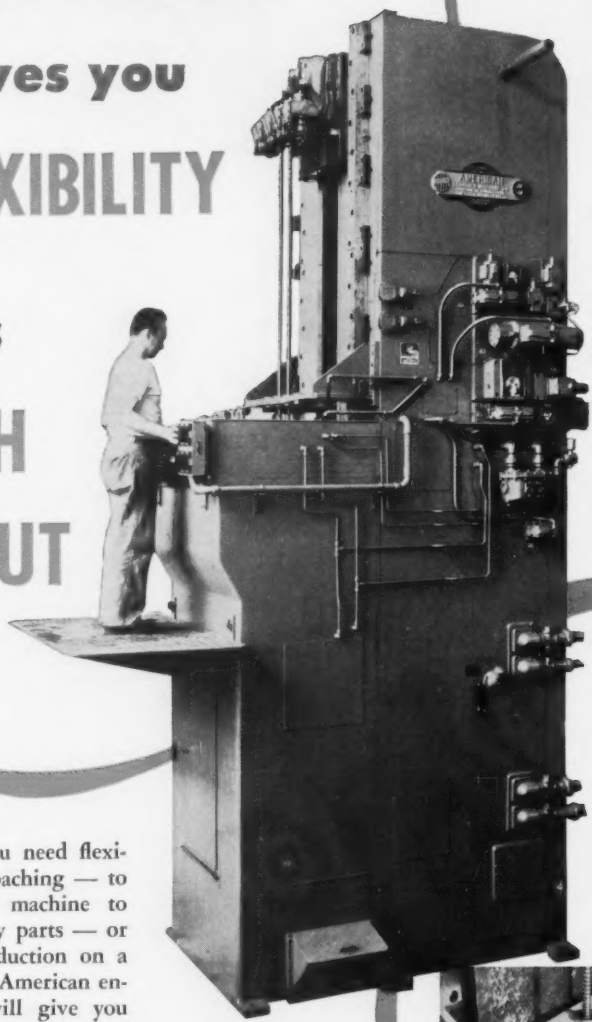
HOBS AND MACHINES SINCE 1911

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

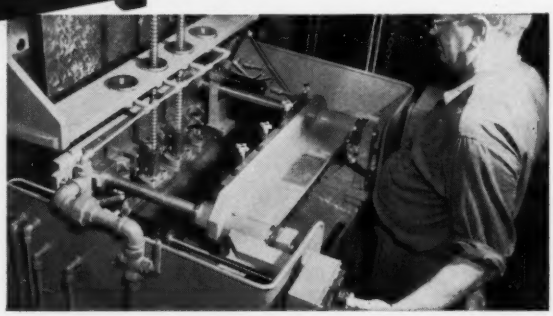
American BROACHING gives you FLEXIBILITY plus HIGH OUTPUT

ANOTHER *American* FIRST

- 30 different universal joint yokes broached on one machine
- Broaching strokes from 48″ to 72″ used to broach parts
- Variable speeds — 35 to 45 second cycle
- Two or four station operation
- Combination round and spline broaches
- Up to 400 parts per hour



Operator loads parts in work nest and swings down forked locating leafs to maintain radial location. Transfer slide, push button actuated, automatically shuttles parts into broaching position. While internal splines are being broached, slide moves back for reloading. At end of broaching stroke, parts are automatically ejected.



Whether you need flexibility in broaching — to enable one machine to handle many parts — or volume production on a single part, American engineering will give you the combination of broaching machine, fixtures and broaches that will assure you maximum high output. To get American's recommendations, write today giving details of your broaching requirements — or ask for new Catalog 450.

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

American Building - Ann Arbor, Michigan

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

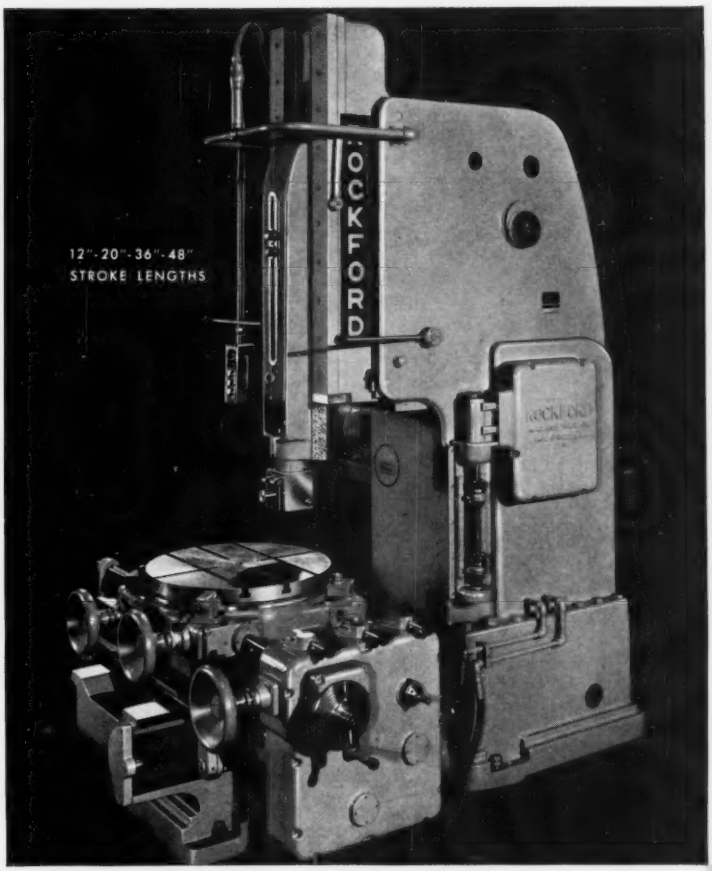
HYDRAULIC

fast, economical production calls for

HYDRAULIC

hydraulic slotters

HYDRAULIC



Hydraulic Drive is a natural for reciprocating-type machine tools. It provides smooth, powerful cutting, fewer moving parts, and longer useful life.

Hydraulic Slotters have power feeds and rapid traverse in all directions, and they may be equipped with Kopy-Kat Duplicators for fast, accurate duplicate-machining. When you modernize your production facilities plan on Hydraulic Shapers, Planers and Slotters to provide the fastest, most economical production methods.

ROCKFORD MACHINE TOOL CO.
2500 Kishwaukee Street • Rockford, Illinois

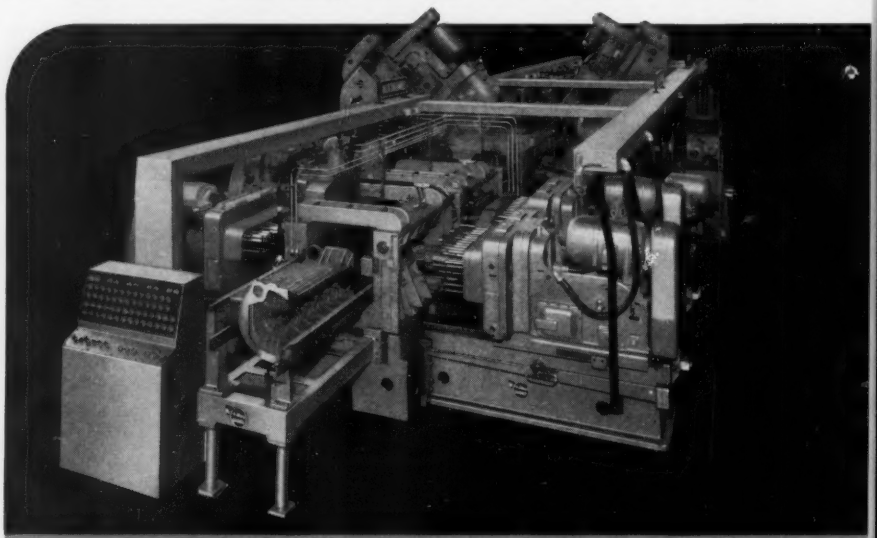
Hy-Draulic

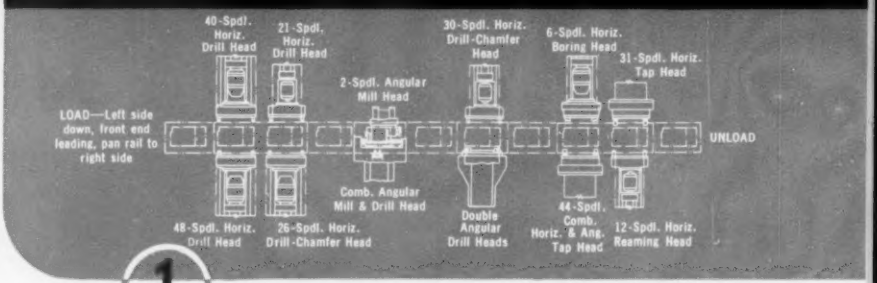
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

DUAL-PURPOSE SPECIALS

● Here's another outstanding example of how W. F. & John Barnes Coordinated Creative Engineering and Manufacturing Service has helped cut production costs . . . this time for a well-known farm equipment manufacturer. These three special machines have been ingeniously designed to machine TWO SIZES of tractor engine blocks . . . double-duty performance that not only means a lower original investment, but also simplifies tooling, reduces floor space requirements, and increases over-all production efficiency. Careful planning of tooling and machine components holds change-over time to a minimum . . . in fact,

Both 4 and 6-cylinder blocks are processed on the same Barnes' Special Machines.




40-Spdl. Horiz. Drill Head
21-Spdl. Horiz. Drill Head
2-Spdl. Angular Mill Head
30-Spdl. Horiz. Drill-Chamfer Head
6-Spdl. Horiz. Boring Head
31-Spdl. Horiz. Tap Head
LOAD—Left side down, front end leading, pan rail to right side
UNLOAD
Comb. Angular Mill & Drill Head
48-Spdl. Horiz. Drill Head
26-Spdl. Horiz. Drill-Chamfer Head
Double Angular Drill Heads
44-Spdl. Comb. Horiz. & Ang. Tap Head
12-Spdl. Horiz. Reaming Head

1 Barnes 11-Station Progress-Thru Machine completes drilling, tapping, and milling operations on the 4 and 6-Cylinder Diesel Engine Blocks. Bushing plates, guide rails, head stops, transfer pusher fingers, and other machine components are quickly adjustable to handle both block sizes.

SAVE TIME WITH BARNES' COORDINATED 6-POINT BUILDING SERVICE

"Shopping around" is often a costly, time-consuming task, and all too often the results are disappointing . . . that's why Barnes offer a complete machine tool building service from *one convenient source* . . . it saves time and cuts costs because all the work is coordinated in one plant. Barnes' service includes:

1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
2. **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.
3. **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control, with circuits that assure the most dependable coordination of all machine functions.
4. **SPECIAL GAUGES, FIXTURES, TOOLS**—designed for each individual machining problem, assure accuracy of operations at high production speeds.
5. **SPECIAL HANDLING AND CONVEYOR EQUIPMENT**—designed and built to reduce work handling, effect maximum safety and efficiency.
6. **COORDINATED DESIGN AND ENGINEERING**—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

W. F. & JOHN BARNES

Builders of Better Machines Since 1872

Multiple Spindle Drilling • Boring

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

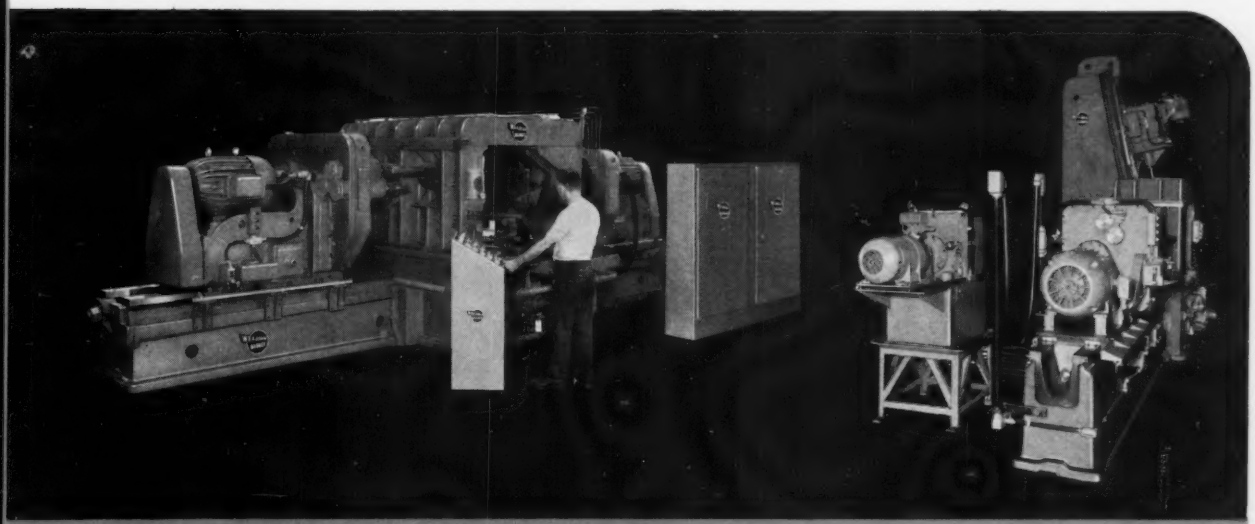
• MACHINE BOTH 4 AND 6 CYLINDER ENGINE BLOCKS

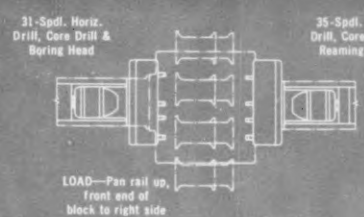
much of the tooling is common to both block sizes and does not require changing. Bushing plates, guide rails, head stops, and transfer pusher fingers quickly and easily adjust to accommodate for variations in the two block designs. Where tooling changes are required, easy accessibility and quick conversion and set-up features speed the change-over.

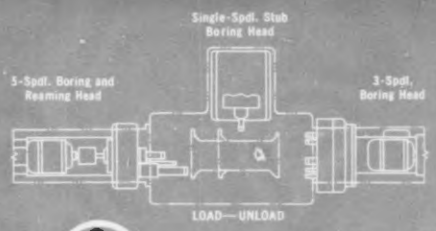
OVER 75 YEARS OF MACHINE TOOL BUILDING EXPERIENCE

This unusual application is only one of many produced by Barnes . . . the result of over 75 years of accumulated knowledge in the highly specialized machine tool field. Creative skills, plus complete and extensive building facilities, assure you of machines possessing maximum capability for lowering production costs and improving product quality.

ASK FOR AN ANALYSIS OF YOUR PRODUCTION METHODS . . . YOUR PROBLEMS WILL RECEIVE EXPERT AND INDIVIDUAL ATTENTION



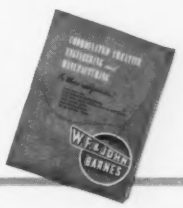

31-Spdl. Horiz. Drill, Core Drill & Boring Head
35-Spdl. Horiz. Drill, Core Drill & Reaming Head
LOAD—Pan rail up, front end of block to right side



2 **Barnes Special 4-Station Progress-Thru Machine completes drilling, boring, and reaming on the blocks. Here again, adjustable features are built in to compensate for the two block sizes. Electrical interlocks on these machines prevent accidental tool damage during change-over. Idle stations are included for future tapping operations.**

3 **Special 3-Way Cam and Crank Boring Machine precision bores both block sizes. Adjustment features are similar to the preceeding machines. All units are electrically controlled for automatic cycle sequence with push-button operation.**

Write Today **FOR YOUR COPY** of "Coordinated Machine Engineering"—a 32-page booklet of automation equipment ideas.



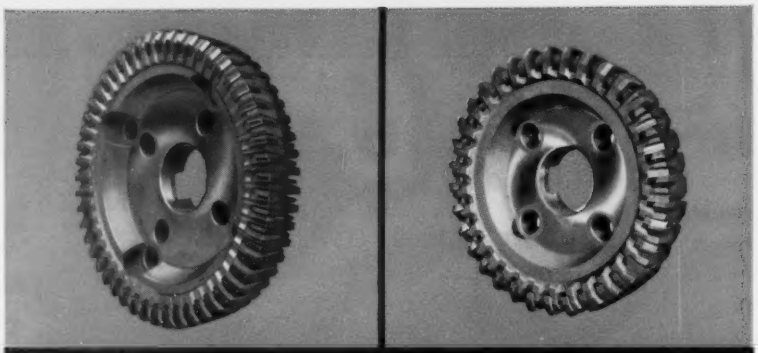
W. F. & JOHN BARNES COMPANY

402 SOUTH WATER STREET, ROCKFORD, ILLINOIS

Tapping Machines • Automatic Progress-Thru and Transfer Type Machines

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

MILLING 110″
BORING 20″
PER MINUTE



SHEAR CLEAR FACE MILL FOR ROUGHING

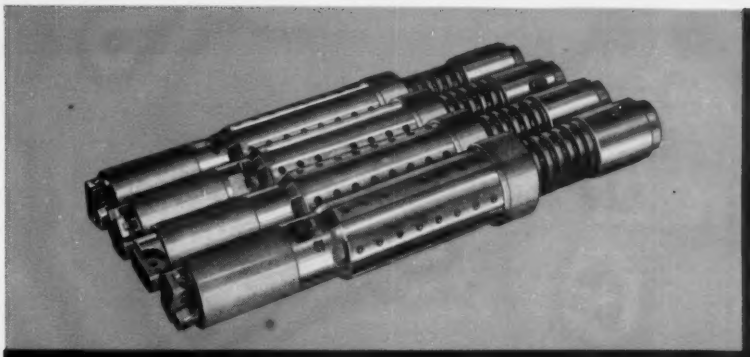
SHEAR CLEAR FACE MILL FOR FINISHING

INGERSOLL *Cutters*

108 AUTOMOBILE CYLINDER BLOCKS PER HOUR are machined automatically on this 11-station Ingersoll machine, one unit of a complete process line. This specially designed 69-station line includes equipment for milling the banks, ends and pan rail, boring the cylinder holes and the cam and crank bearings, as well as many other operations. In order to obtain high production, milling feed rates of 110″ per minute are necessary.

Write today for Cutter Catalog 60B, describing the complete line of Ingersoll inserted blade milling and boring tools.

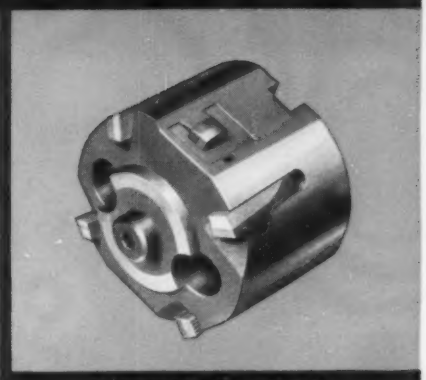
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



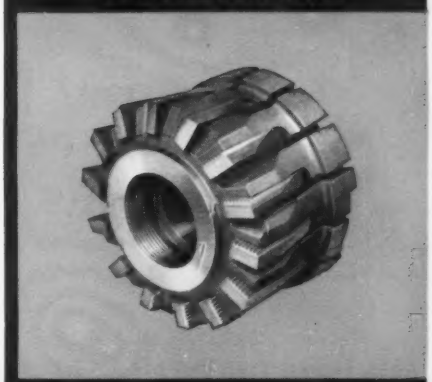
CYLINDER CHAMFERING BARS

ROUGH CAM AND CRANK BORING TOOLS

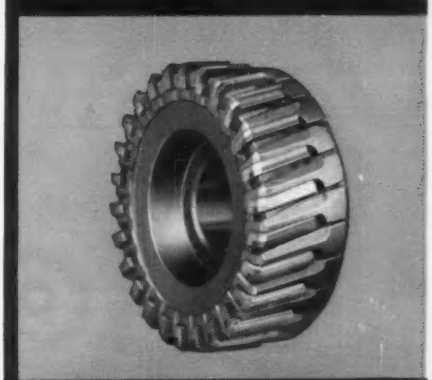
FINISH CAM AND CRANK BORING TOOLS



COMBINATION SEMI-FINISH AND FINISH CYLINDER BORING TOOL



ROUGH CYLINDER BORING CUTTER



SPECIAL FACE MILL

These are a few of the Ingersoll milling cutters, boring tools and chamfering bars built for a 69-station lineup of Ingersoll process machines for an automobile manufacturer. The high production and close accuracies required of these machines were made possible, in large measure, by the efficiency of these special cutting tools.

Experience gained in meeting demands such as these is reflected in continuous improvement of the basic design of all Ingersoll tools. Applied to Ingersoll inserted blade cutters, such advancements mean higher feed rates and greater production in all kinds of work, on all makes of milling and boring equipment.

Ingersoll cutter engineers are available to study details of your work and recommend cutting tools for your individual production needs.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES

THE ORIGINATORS OF SHEAR CLEAR CUTTERS

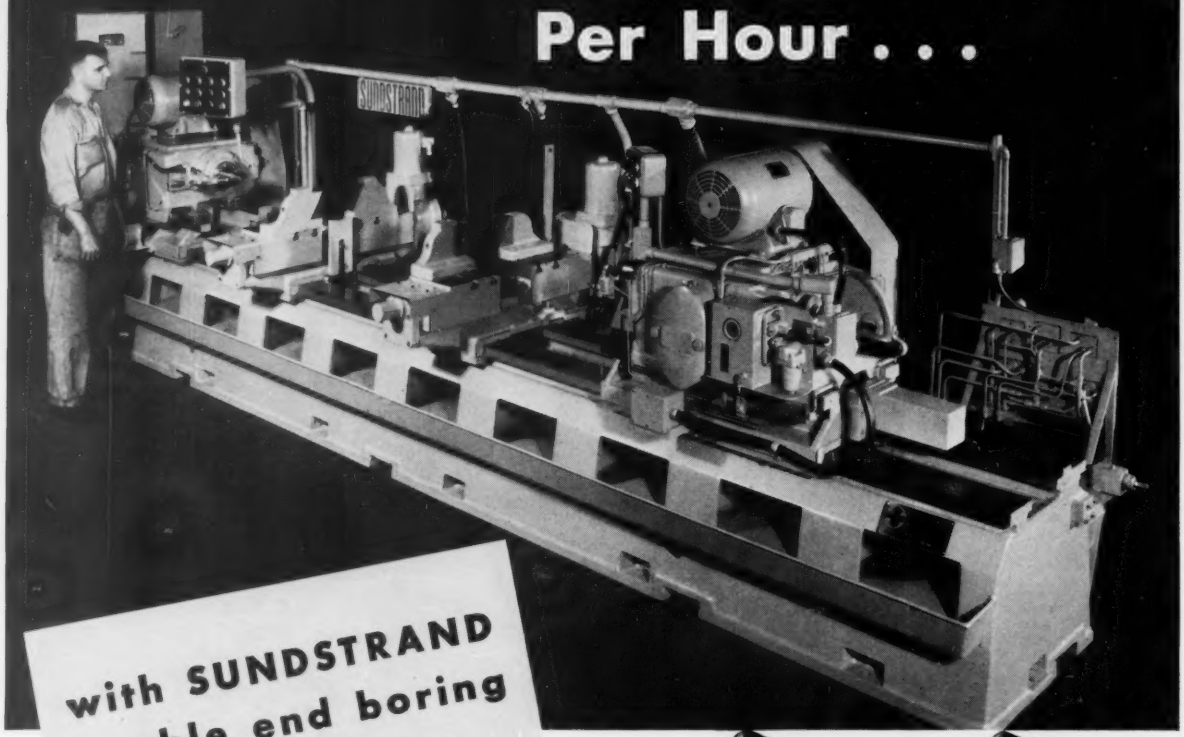
INGERSOLL

MILLING MACHINE COMPANY

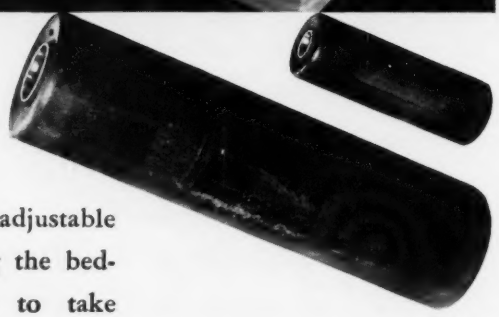
ROCKFORD, ILLINOIS, U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Production Increased from 20 to 60 Pieces Per Hour . . .



with SUNDSTRAND double end boring machine



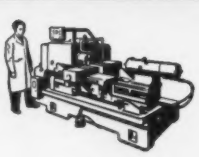
This Sundstrand Double End Boring Machine has been equipped with tooling to bore, face and chamfer conveyor rollers. Twenty-two sizes of rollers are machined varying from 4″ to 7″ in diameter, and from 6-11/32″ to 9′ 6″ in length. Both vises and the right hand head are adjustable along the bedways to take care of the varying lengths of parts. Both heads operate in an automatic cycle to bore at a preset depth, face and chamfer and rapid return.

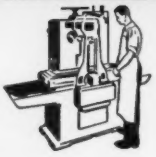
SUNDSTRAND

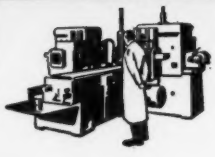
50 YEARS OF *"Engineered Production" Service*

*REG. U.S. PAT. OFF.

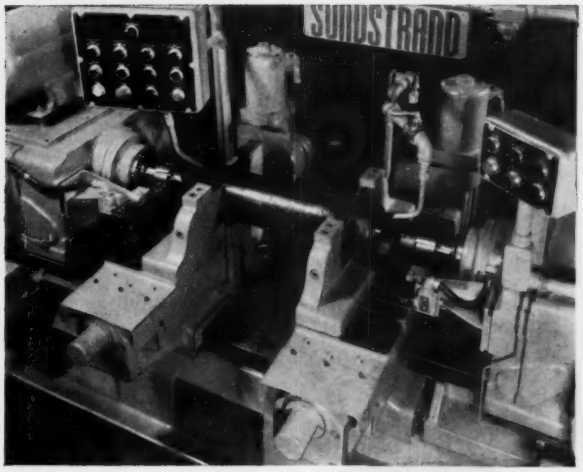
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS







CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



Tooling and job data

when you want Production at lowest cost use SUNDSTRAND "Engineered Production" Service

Rollers are of 1010 to 1020 steel and are machined in lot sizes varying from 50 to 3000 pieces. Tools used are of the combination boring, chamfering and spot facing type with carbide inserts. Shown above is a close-up of the tooling used on this double end boring machine. Parts are power clamped and machine is operated with push button controls.

This is only one of many productive installations that has resulted from Sundstrand "Engineered Production" analysis and service.

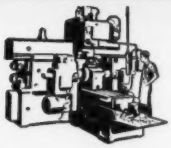
Basically, there are two approaches to solving metal working problems: (1) obtaining standard machines, then trying to process parts over these machines as economically as possible; (2) designing the most profitable processing method first, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machines, when necessary. The latter is the Sundstrand method.

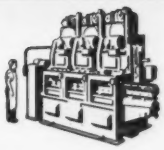
Additional data

on Sundstrand "Engineered Production" solutions are covered in these two bulletins. Write for your copies today. Ask for bulletins 656.

See Sundstrand machines in action in Booth No. 1412 at the Machine Tool Show, International Amphitheatre, Chicago, September 6-17, 1955.

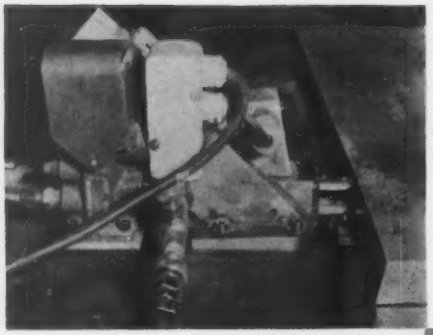
TRIPLEX RIGIDMILS | SPECIAL MACHINES



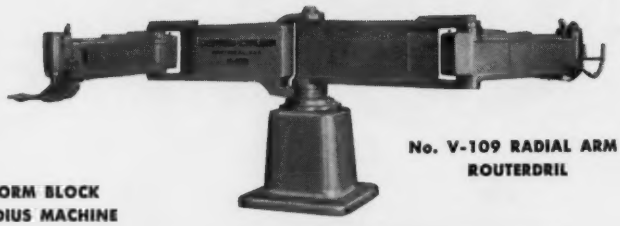


SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



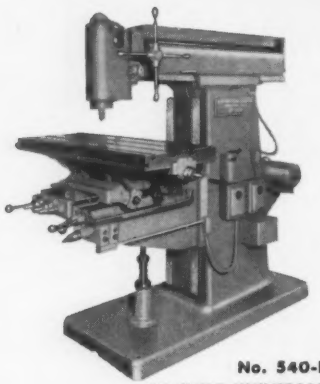
FORM BLOCK
RADIUS MACHINE



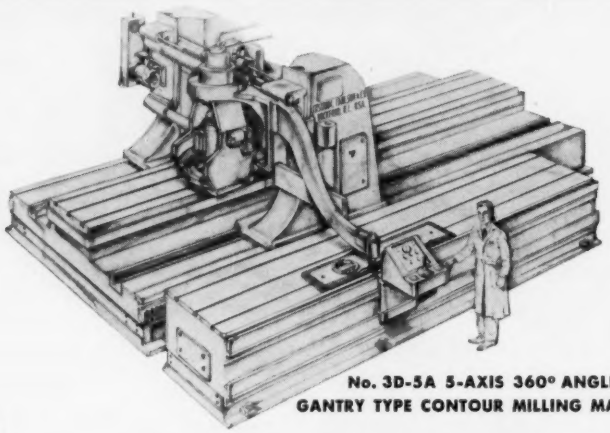
No. V-109 RADIAL ARM
ROUTERDRIL

FOR GREATER AIRCRAFT PRODUCTION!

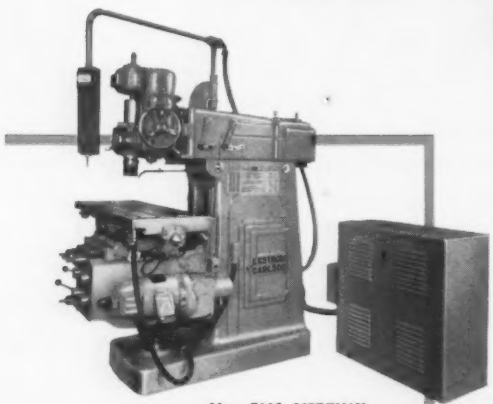
New concepts—new designs—new mechanisms—new highs in production capacities—new standards of performance . . . these outstanding attributes are typical of Ekstrom, Carlson & Co. products for the aircraft industry! Look over the many items shown here—pick out those that may fit your present and future plans—then write for free literature giving full and interesting information.



No. 540-HC
HI-CYCLE UNIVERSAL ROUTERMIL

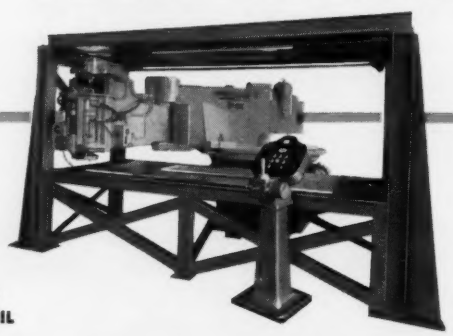


No. 3D-5A 5-AXIS 360° ANGLE
GANTRY TYPE CONTOUR MILLING MACHINE

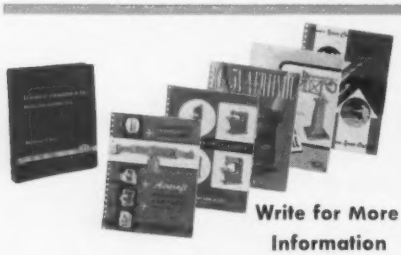


No. 5VA VERTIMIL

MACHINES



No. 400
CAV-RO-MIL

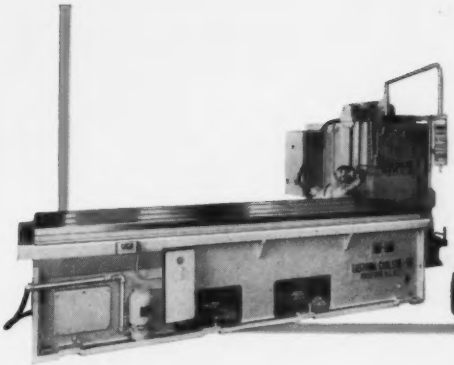


Write for More Information

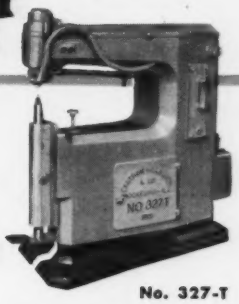
EKSTROM, CARLSON & CO., DEPT. M-4, 1400 RAILROAD AVE., ROCKFORD, ILL.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

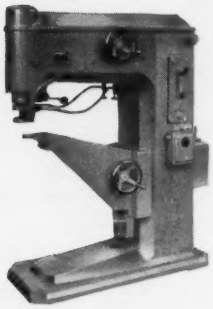
No. 71C-DS
2-SPINDLE RADIAL ARM DRILL



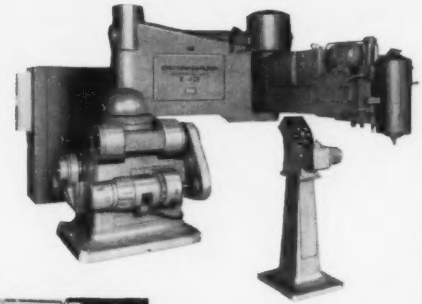
No. SM-100
SCARF AND EDGE
MILLING MACHINE



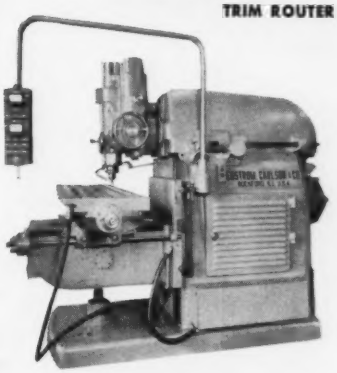
No. 327-T
TRIM ROUTER



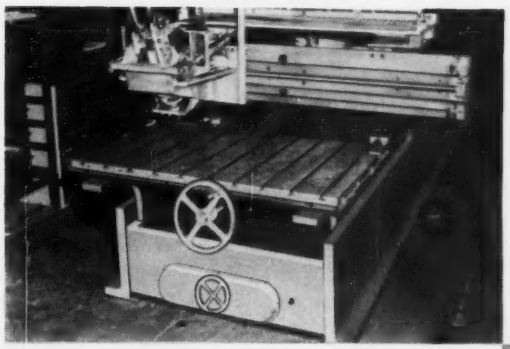
No. 434-H HORN ROUTER



No. E-121
ALL-ELECTRIC
CONTOUR ROUTER

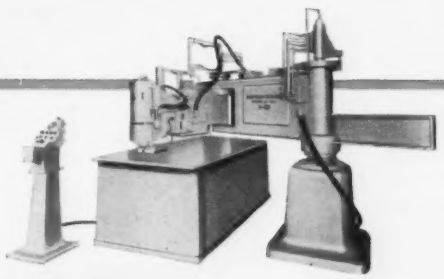


No. 6-E VARI-SPEED
VARI-FEED COMPOUND
VERTICAL MILL



CONTOUR AND BEVEL ROUTER

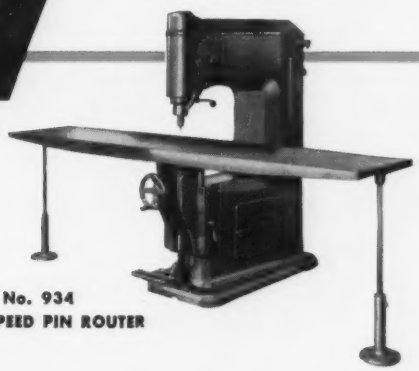
and **TOOLS**



No. H-121
HYDRAULIC-ELECTRIC CONTOUR ROUTER

by EKSTROM, CARLSON

SPIRAL FLUTE ROUTER BITS

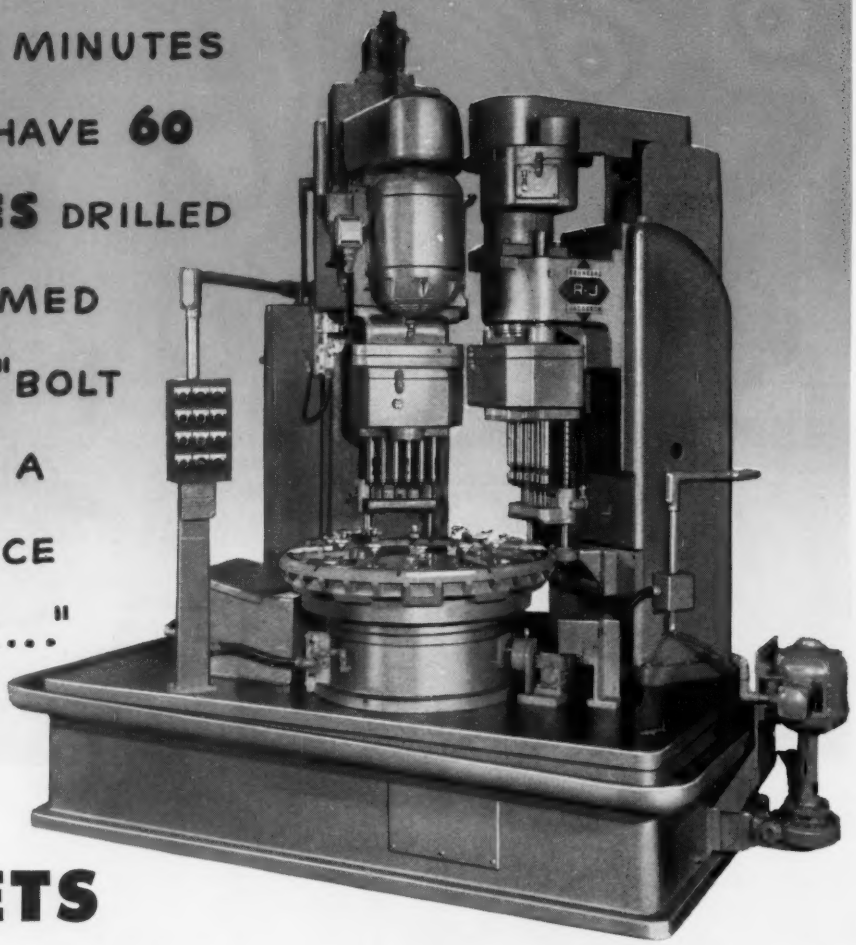


No. 934
HIGH SPEED PIN ROUTER

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Rehnberg-Jacobson

"LOAD IT, START IT, AND WALK AWAY... COME BACK IN **6** MINUTES AND YOU HAVE **60** **5/16" HOLES** DRILLED **AND** REAMED ON A 34½" BOLT CIRCLE IN A STEEL PIECE 3/4" THICK..."



FOR JETS

This little trick is used for putting the 60 bolt holes in a stator blade adjusting spacer for a well-known make of jet engine. An important requirement is that the holes must be equally spaced within .005" of each other. The table has ten positions, as you might guess from the 6-spindle heads. Actually, it makes 14 indexes; on the first two the reamers don't work, and on the last two the drills hold back — all automatically. The machine is simply constructed of mostly standard elements, openly designed for easy work handling, is easy to operate, and easy on the maintenance crew. Those features are characteristic of Rehnberg-Jacobson machines.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

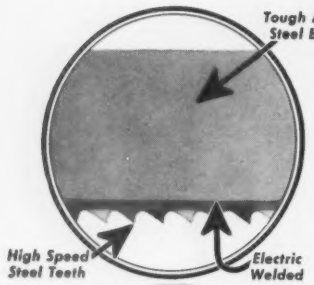
R-J

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

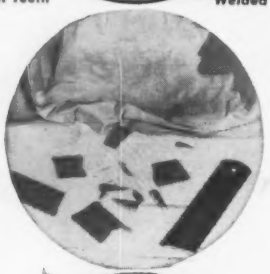
HERE'S A WAY TO Cut Costs
LAMINUM® shims are easily and quickly adjustable. The laminations of brass, steel or aluminum are held together by a microscopic binder. They p-e-e-l for fast, accurate assembly. No counting of loose layers, no stacking, no miking. Less machining and finishing. Save in maintenance adjustments, too.
LAMISOL® shims, with layers tack-bonded at edges, are also available in brass, steel, stainless steel, aluminum.
LAMINATED SHIM COMPANY, INC.
100 UNION STREET
GLENBROOK, CONN.
Send for FREE Brochure on how to save with Laminum Shims and Lamisol Shims

Features Essential to Top Hack Saw Blade Performance



UNBREAKABLE—to saw FASTER.

Composite construction (a narrow high speed steel tooth edge electrically welded by the MARVEL-invented process to a tough, non-brittle alloy steel body), means that MARVEL high-speed-edge can be subjected to the MAXIMUM feed pressure that any hack sawing machine is capable of applying. MARVEL blades need not be "babied" for fear of breakage!



SHATTERPROOF—for SAFETY.

MARVEL blades never shatter or "explode" as do the ordinary "brittle" blades shown at left which so often cause personal-injury accidents such as the loss of an eye or severe laceration and expensive damage to the sawing machine. Operators who use MARVEL blades exclusively soon "get the habit" to apply heavier feeds, greater blade tension, higher speeds—to do their work faster, because they know they are SAFE with MARVEL.

SHARPER, PREMIUM-STEEL TEETH—to wear LONGER.

Teeth are accurately machined by a MARVEL-invented process that assures sharper tooth points and positive uniformity of tooth shape and degree of set from end-to-end of every MARVEL blade. The steel used in the tooth edge is carefully selected from the finest high speed steels available throughout the world, regardless of cost or source—truly premium steels, without premium cost.

QUALITY CONTROL—to assure UNIFORMITY.

With more than a quarter century of *experience* in inventing, perfecting, and producing welded-edge hack saw blades, MARVEL has provided its own laboratory with the most modern metallurgical instruments and techniques known to the applicable sciences for the specific purpose of maintaining highest possible quality control. Coupled with rigid tests and meticulous inspection of every MARVEL blade, uniform quality is assured.

These are only a few features that make MARVEL High-Speed-Edge Blades such outstanding performers

Ask for the latest MARVEL Cutting Tool Bulletin and the name of your closest MARVEL Distributor.

MARVEL *Metal Cutting* SAWS

Better Machines-Better Blades

Manufactured only by

ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39 U S A.

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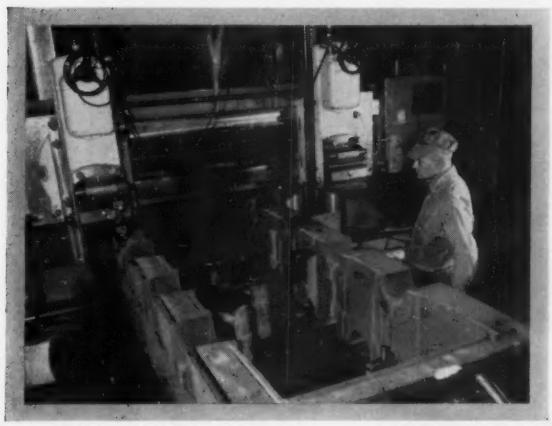
Morgan Engineering Co. now gets full efficiency from high-speed planer as...

Carboloy Grade 370 carbide cuts production time 50% on steel-cutting "problem" job

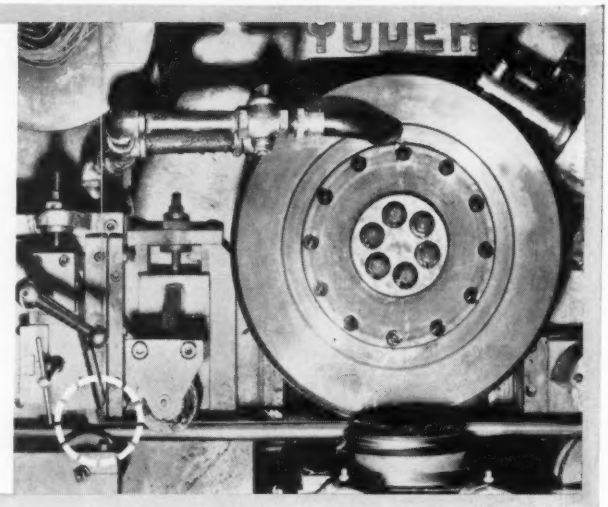


Here's still more proof that there are no known "equivalent grades" for Carboloy® Series 300 carbides for medium- and heavy-duty steel-cutting:

PLANING CAST STEEL GEAR CASE. Long planer cuts on this 1-ton cast steel gear case cause thermal cracking in any carbide. Former tools had to be "babied along" to prevent excessive downtime for tool changes. Switching to Carboloy Grade 370, Morgan Engineering Co. now runs their high-speed planer four times faster . . . removing nearly 2000 cubic inches of metal before regrinding to eliminate thermal cracks. Production and tool life are doubled; machine efficiency is up 15%.

SETUP: Material—1-ton cast steel forging. **Speed**—160-180 SFPM. **Feed**—0.040-0.080 inch. **Depth of cut**—$\frac{5}{16}$-$\frac{1}{2}$ inch. **Coolant**—No.

Carboloy Grades 350 and 370 increase machine output, lower tool costs. Here's the complete story . . .

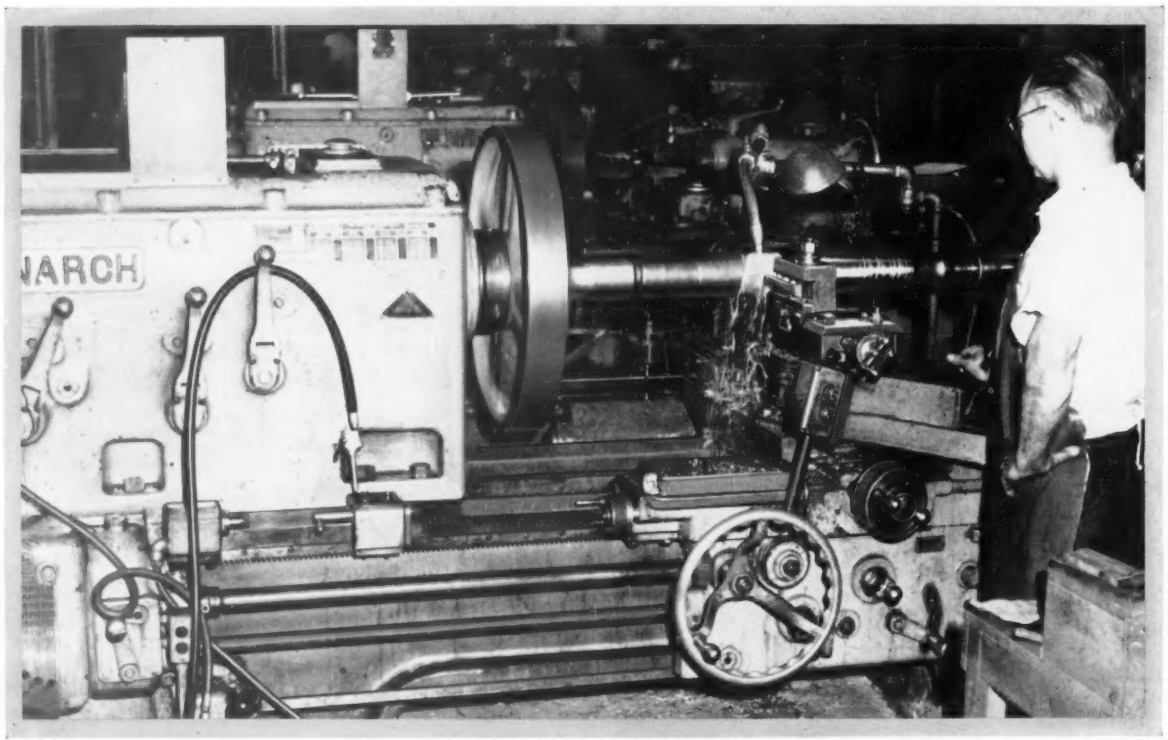


FLASH TRIMMING steel tubing at 2400°F ruined tools quickly at Bissell Carpet Sweeper Co., Grand Rapids, Mich. Switching to a standard Grade 370 tool eliminated costly special carbide tool; boosted production 14%. Line now operates full day without tool change.

SETUP: **Material**—cold-rolled steel. **Speed**—50-60 SFPM. **Coolant**—No.

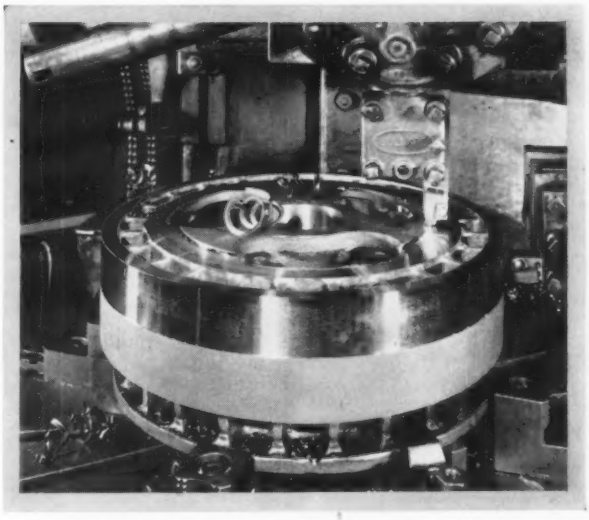
Case histories prove there are no known "equivalent grades"—

Carboloy 350 and 370 outperform



TURNING landing-gear piston with Grade 350 saved Menasco Mfg. Co., Burbank, Calif., ½ hour per shift in downtime. Other carbides produced 2 parts per grind at 125 SFPM; Grade 350 cuts at 185 SFPM with 6 times the production per grind.

SETUP: **Material**—4340 heat-treated forged steel. **Speed**—185 SFPM. **Feed**—0.010 inch. **Depth of cut**—0.060-0.200 inch. **Coolant**—Yes.



FACING power shovel clutch and brake drum assembly with Grade 370 inserts cut over-all machining costs almost 70% for a Chicago mining machine manufacturer. Two Grade 370 clamp-on blanks replaced 16 tools.

SETUP: Material—1045 low carbon, high manganese cast steel, with hardness of 27 R_c. **Speed**—24 RPM. **Feed**—0.018-0.033 inch. **Depth of cut**—⅜ inch. **Coolant**—No.

all other steel-cutting carbides

Boost production as much as 366%; reduce downtime losses, tool costs

Hundreds of metalworking plants are now using Carboloy Grades 350 and 370 on their toughest steel-cutting jobs. And from plant after plant come reports of:

Reduced production time because Carboloy Series 300 carbides maintain efficiency at faster speeds, greater feeds, deeper cuts.

Reduced downtime because these new grades can take the punishment of high-speed machining . . . and stay on the job.

Reduced tool costs because Grades 350 and 370 take more regrinds; often eliminate rough finishing operations and tools.

Increased machine efficiency because Series 300 carbides have the strength and versatility to let you operate machines at upper performance limits.

The new, carefully controlled Carboloy process used in producing Series 300 imparts built-in structural rigidity *at the cutting edge*. Both Grade 350 and 370 can operate efficiently around 1800°F . . . a range where the cutting edges of other carbides deform, greatly reducing their effectiveness.

Your Authorized Carboloy Distributor can give you immediate delivery on Carboloy standard tools, inserts, and blanks in Grades 350 and 370 . . . in a wide range of sizes and styles. For the new Series 300 price list GT-305, send coupon on the next page, today.

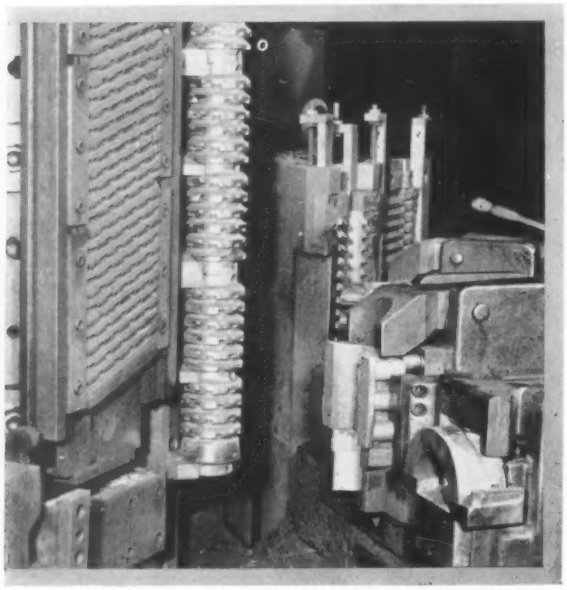
CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

OVER→

Carboloy Created-Metals for Industrial Progress

If you're machining cast iron,
nonferrous metals, or plastics . . .

There's a Carboloy grade to fit your needs



BROACHING automobile bearing caps with Carboloy Grade 883 brought Studebaker a 22% saving in over-all costs. Carbide on previously used broach lasted a maximum of 24 hours; Grade 883 ran 50 days.

SETUP: **Material**—highly abrasive cast iron. **Speed**—28 SFPM. **Chip load per tooth**—0.005 inch for roughing; 0.0015 inch for finishing.

Carboloy tools, blanks, and inserts are available in many standard grades for machining cast iron, nonferrous materials, and plastics — as well as steel.

These grades are stocked in a wide range of sizes and styles by your Authorized Carboloy Distributor. He'll provide immediate local delivery to help you keep inventory costs down.

And your Distributor can give you expert assistance with any machining problem you may have . . . recommending the correct carbide grade and tooling method that best suits your particular job.

Send coupon, today, for price lists and specifications on Carboloy grades.

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

MANUFACTURERS OF CEMENTED CARBIDES, PERMANENT MAGNETS, THERMISTORS, HEVIMET, AND VACUUM-MELTED METALS

CARBOLOY
Department of General Electric Company
11147 E. 8 Mile Ave., Detroit 32, Michigan

☐ Please send price list and specifications on steel-cutting Grades 350 and 370.

☐ Please send price list and specifications on other standard grades.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

AUTHORIZED CARBOLOY CEMENTED CARBIDE DISTRIBUTORS

See the Yellow Pages

. . . for the name of your local Authorized Carboloy Distributor. You'll find his name under the Carboloy trademark listing in classifications: TOOLS or TOOLMAKERS.

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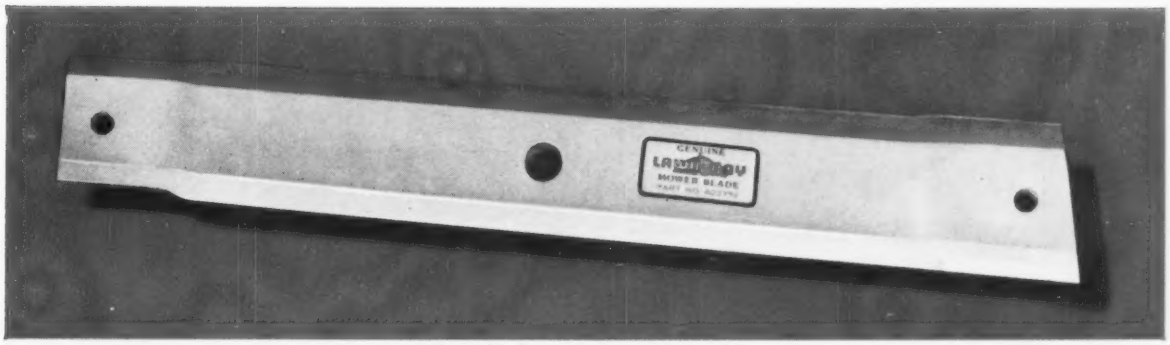
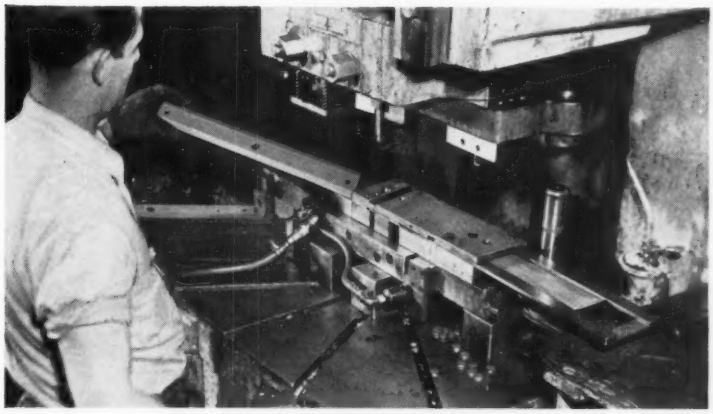
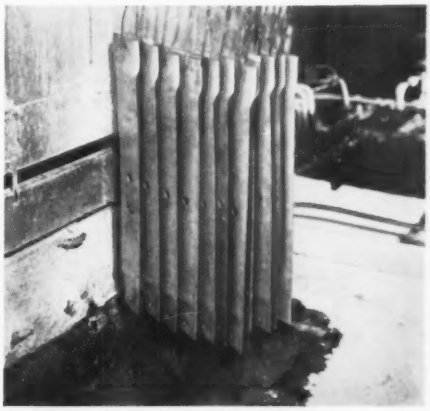


Cutter blade of Crucible alloy steel.



First step in manufacture of cutter blade. Crucible beveled blade alloy steel is fed through this 100-ton press, where it is cut to length and holes punched.



Next, lengths are formed to shape on a hydraulic press, and then given a tempering bath as shown.

CRUCIBLE ALLOY STEEL *cuts blade damage in rotary mowers . . .*

Lawn-Boy mower. Built by RPM Manufacturing Co., Lamar, Mo., a subsidiary of Outboard, Marine & Manufacturing Company, maker of Johnson & Evinrude outboard motors.

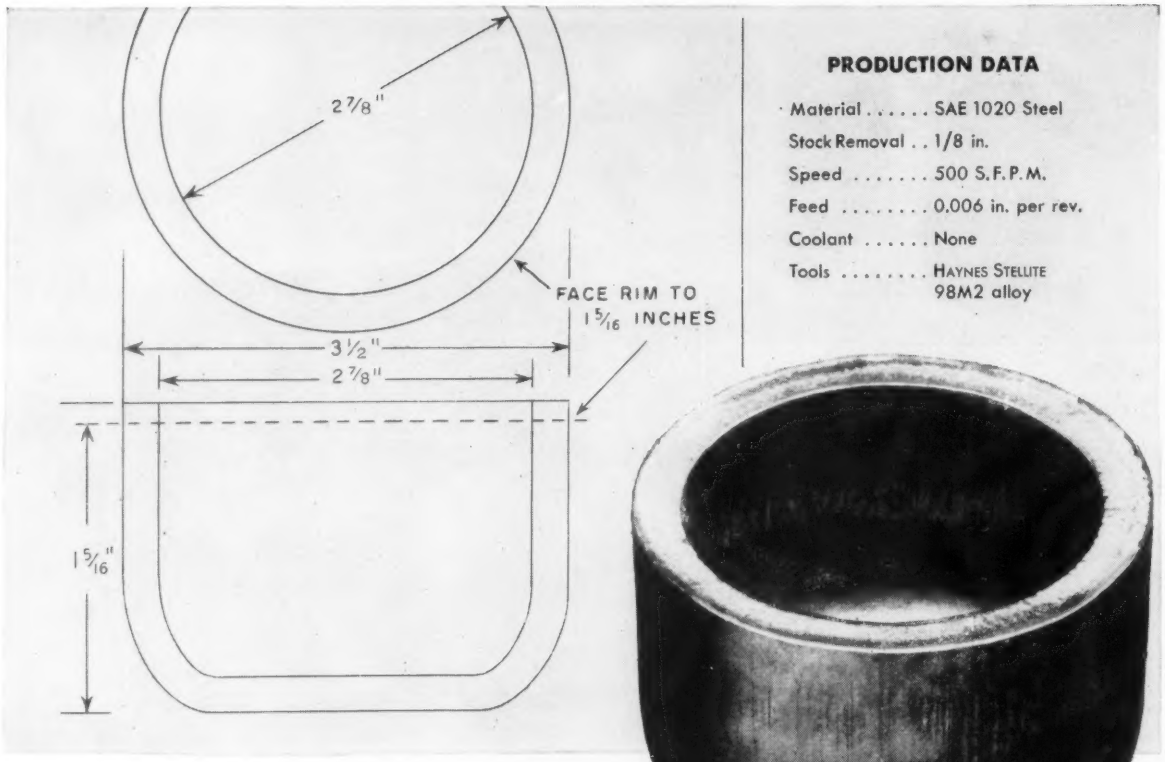
Rotary lawnmower cutter blades, whirling at high speeds, often hit small rocks or bits of trash. Ordinary steels just can't take that sort of rugged treatment. They chip, crack – wear out far too quickly. That's why in leading mowers, like the new *Lawn-Boy*, you'll find special *alloy* steel cutter blades *designed for reliable performance.*

For Crucible has developed a *special alloy steel* made to give the best possible combination of toughness and hardness for long-lasting edges—and formability and ductility for ease of manufacture. It's been so successful that *Crucible is now the largest producer of lawnmower steels.*

Most Crucible steels are designed to fill *special* needs. If you have an application where ordinary steels won't do, come to Crucible. Take advantage, too, of the dozens of technical booklets and data sheets Crucible has prepared to help you make the best use of special steels. For a free publication catalog, write *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

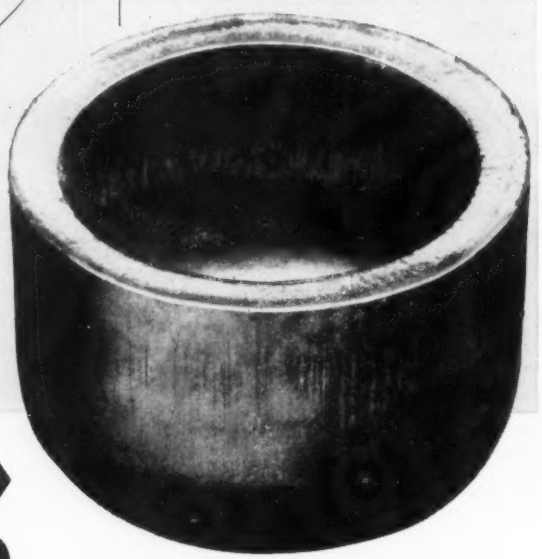
CRUCIBLE **first name in special purpose steels**

Crucible Steel Company of America



PRODUCTION DATA

Material	SAE 1020 Steel
Stock Removal	1/8 in.
Speed	500 S.F.P.M.
Feed	0.006 in. per rev.
Coolant	None
Tools	HAYNES STELLITE 98M2 alloy



1,000 PIECES MACHINED PER GRIND ...despite rough, uneven cut

HAYNES STELLITE 98M2 tools machine over a thousand of these torque converter cups between grinds. The cups are deep drawn from SAE 1020 steel, and are plunge cut. The area to be machined is rough and uneven. The HAYNES STELLITE tools operate for a full eight-hour shift, at a speed of 500 surface feet per minute, without chipping or spalling. No coolant is used.

HAYNES STELLITE tools are successful on applications like this one because they have good impact strength, high compressive strength, and their cutting edges remain hard and sharp even when red hot. This same combination of properties makes them valuable on all machining jobs. They remove metal fast. They can be used at high speeds with comparatively high feed rates, and they can take deep cuts.

For information on how HAYNES STELLITE tools can help speed up your machining jobs, write for the booklet, "HAYNES STELLITE Metal-Cutting Tools." It gives helpful information on chip formation, tool design, and the machinability of metals.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

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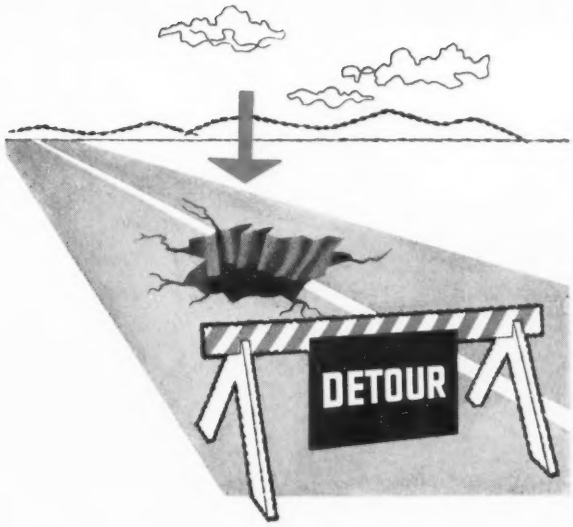
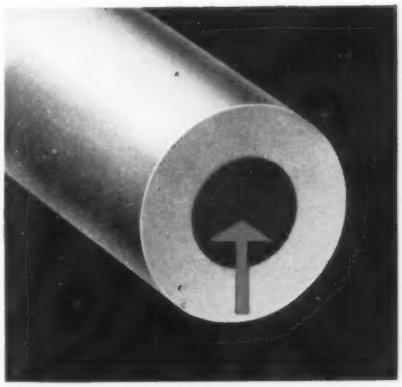


a hole here wastes time . . .



a hole here saves time

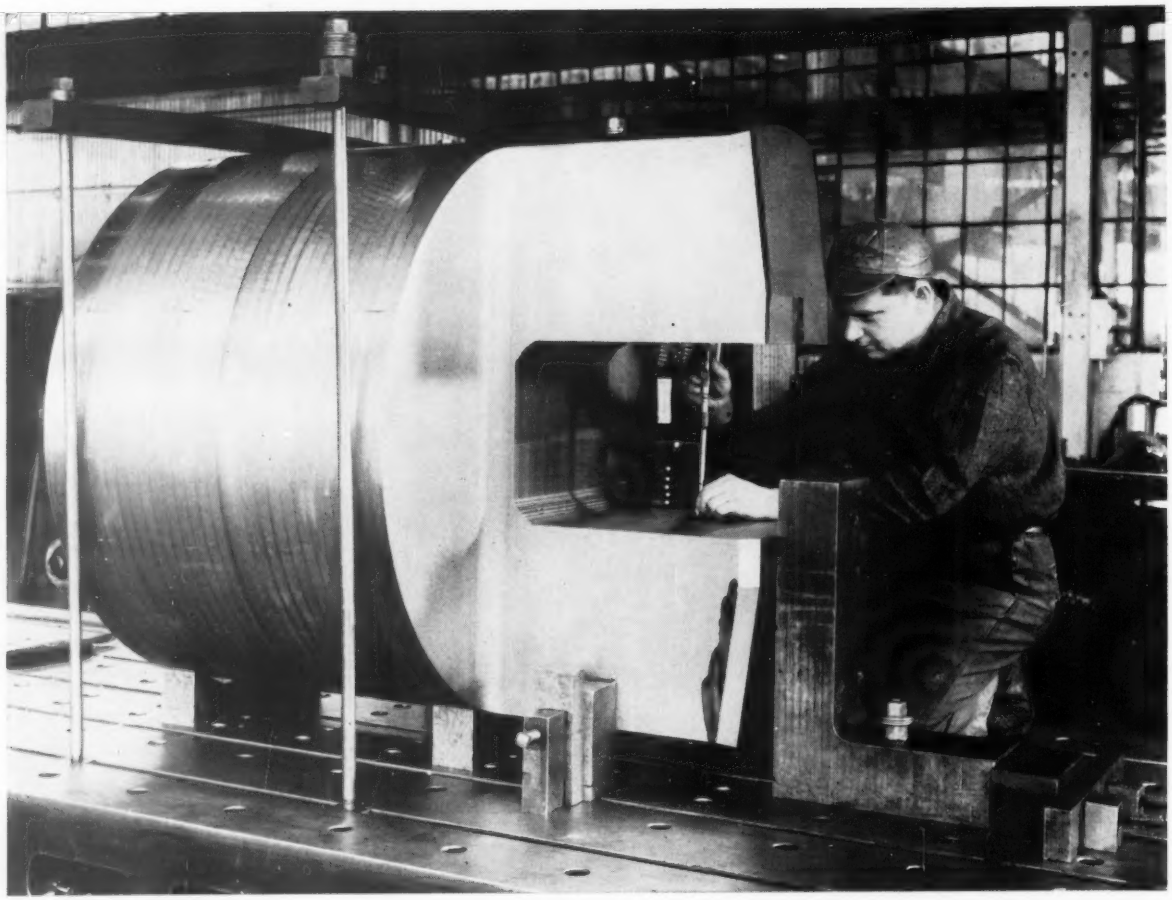
Crucible Hollow Tool Steel Bars save time — and money too — whenever you need ring-shaped steel parts, or tools with a center hole. The tool steel is drilled through when you get it! You don't need to bore, drill, hole-saw, cut off or rough-face. That's why they cut your production time, increase machine capacity — and reduce scrap losses.

You can get these hollow bars in any of Crucible's famous quality tool steels, in almost any combination of OD and ID sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening; SANDERSON water-hardening; AIRDI 150 high carbon, high chromium; AIRKOOL air-hardening; and NU DIE V hot-work tool steels — from the Crucible warehouse near you.

Call your Crucible representative for the full story of how these steels can save time and money in your shop. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

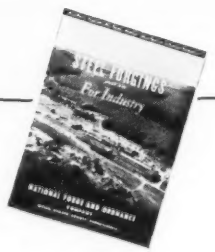


This Forging is made for really HEAVY DUTY-

Transmitting power under constant heavy vibration and sudden severe shock loads is the future in store for this giant mill coupling. It was National Forged as a double with its mating end from a single huge ingot. It is 40-50 carbon steel treated to 72,000 Min. tensile strength with 39,000 elastic limit. This forging and its adjoining coupling are 40″ in diameter x 48-1/4″ long and weigh 9,800 lbs. each. They are being machined to fractional inch tolerances to keep clearances at a minimum. This care in machining is extremely important to long operational life.

National Forge is equipped to turn out any steel to your exact analysis and finish machine to your exact specifications.

Whether your forging requirements are large or small, simple or intricate . . . try National Forge next time.



Send for your free copy of National Forge's New Bulletin explaining their Operations and Facilities.

NATIONAL FORGE AND ORDNANCE COMPANY
PRODUCES BETTER STEEL FORGINGS AND MACHINE WORK
IRVINE, WARREN COUNTY, PENNSYLVANIA

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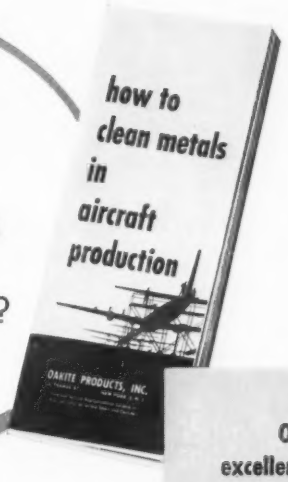
WHAT IS YOUR TOUGHEST CLEANING JOB IN AIRCRAFT PRODUCTION?



¶ **That's** hard to answer, isn't it? Maybe it's hard to remove smut from one alloy; no problem with other alloys. One drawing compound may harden into all kinds of trouble; others may wash away in a wink. ¶ **But,** whether it's an oxide or a weld flux or a stencil mark or a synthetic enamel that gives you a headache today, your Oakite Technical Service Representative is pretty sure to be able to help you laugh it off tomorrow. ¶ **Several** of our customers helped us make a list of jobs on which we could give them the most help. The table at the right shows these jobs in order of volume rather than toughness. There is some overlapping in the listings and some of the jobs – like machining, grinding, forming and preventing corrosion – are not strictly cleaning jobs. But every one is a job for which we have a material or a method that may be worth a lot of money to you. ¶ **You** may not agree with the ranking of these jobs. But a glance at the list may stimulate your ideas about improving some of your operations. If you'll circle in the coupon the numbers of the jobs that interest you, we'll be glad to tell you about Oakite materials designed for your work.

FREE Our 48-page illustrated booklet *"How to Clean Metals in Aircraft Production"* contains information on all the cleaning jobs in the list.

Oakite has excellent materials for all these jobs:

1. Cleaning aluminum
2. Stripping paint with solvent strippers
3. Stripping paint from steel (hot tank)
4. Machining and grinding
5. Deoxidizing aluminum
6. Steam cleaning aluminum
7. Steam cleaning steel
8. Deflocculating paint in spray booths
9. Metal forming
10. Stripping paint from aluminum (hot tank)
11. Removing corrosion and preparing for painting
12. Descaling
13. Preventing corrosion
14. Cleaning magnesium
15. Electrocleaning steel
16. Barrel finishing
17. Plant maintenance cleaning and sanitizing

OAKITE PRODUCTS, INC., 26 Rector St., New York 6, N. Y.

Send me a FREE copy of your booklet *"How to Clean Metals in Aircraft Production."*
I especially wish to obtain better results in the jobs indicated by the numbers circled below:

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17

NAME_____

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SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

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DoALL *finds that Nickel Alloys combine needed properties such as:*

High wear resistance plus ready machinability

Nickel Cast Irons, Nickel Steels and Ductile Iron contribute to the ruggedness and wear-resistance of grinders . . . standard and special . . . produced by the DoALL Company, Des Plaines, Ill. Bases, tables, saddles, vertical slides, taper gibs, wear strips and sub-plate, on standard surface grinders are of 1½-2% nickel alloy iron. This iron is also used for similar important castings in the DoALL special rotor plunge grinder.

SPECIFY almost any logical combination of strength, toughness, hardness, corrosion resistance or other needed properties . . .

And you'll usually find a standard material that exactly answers both your fabricating and service demands from among the many grades of nickel alloys.

In fact, you'll probably discover . . . as DoALL did . . . that nickel alloys provide advantages which no unalloyed composition can match.

Properties combined in nickel-containing alloys contribute, for instance, to the efficiency of many components in the widely used DoALL grinders . . . both standard and special. Parts that must combine a high degree of wear resistance plus ready machinability, for example, are cast in alloy irons containing 1.50 to 2.00% nickel.

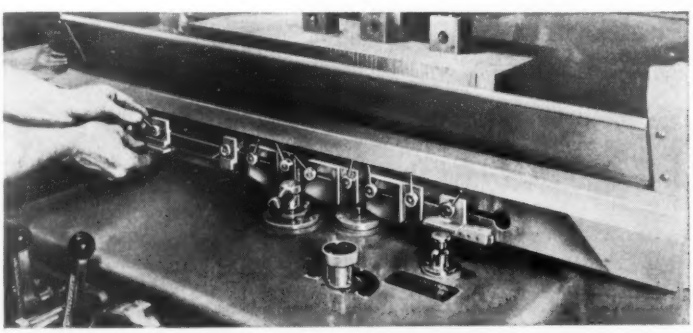
And components that call for resistance not only to wear, but also for some resistance to shock loads or sudden stresses, are cast in Ductile Iron fortified with about 1.50% nickel.

Spiral gears and arbors on standard DoALL types, and also pistons for special rotor grinders, are specified in a casehardened 8600 series nickel alloy steel. This grade of nickel-containing steel makes possible a wear-resistant surface supported by a core that resists fatigue and shock. A direct hardened steel of this same series is used for certain stressed gears in DoALL special grinders.

The advantages of weight saving, compactness, durability and strength . . . along with superior response to fabrication . . . may generally be obtained by using the correct nickel alloy. Whatever your industry, let us help you with your metal problems. Send us details for our suggestions. Write us today.

INCO
TRADE MARK

Ductile Iron trip dogs help DoALL grinders achieve peak precision and output. These components are easily spaced to speed up table motion desired between parts or jigs during slow "crush form" grinding of precision parts.



THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N. Y.

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Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

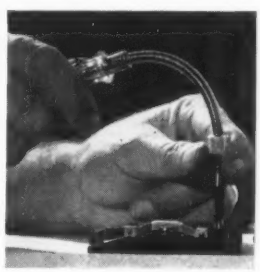
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

They Wing Screw Drivers at Fast Clip with Dies of BTR

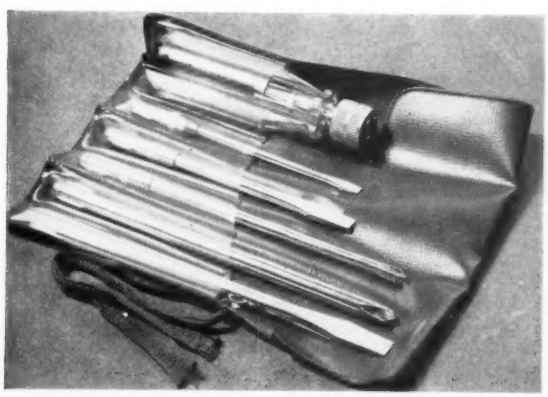
It's efficiency-plus at the busy plant of Oxwall Tool Co., Ltd., Oxford, N. J. For here there's every kind of machine for the high-speed manufacture of all kinds of quality screw drivers. They turn them out by the millions, large and small, including an ingenious worm-like screw driver which can be bent around corners at the touch of a finger.

The plant has a battery of 10-ton presses where the wire blank is winged on the end opposite the blade (see illustration above) so that it can be anchored in the plastic handle. The typical forming dies used in this operation are made of BTR (Bethlehem Tool Room) tool steel. Oxwall engineers tell us that these BTR dies, hardened to Rockwell C48-50, are giving long service life in this application.

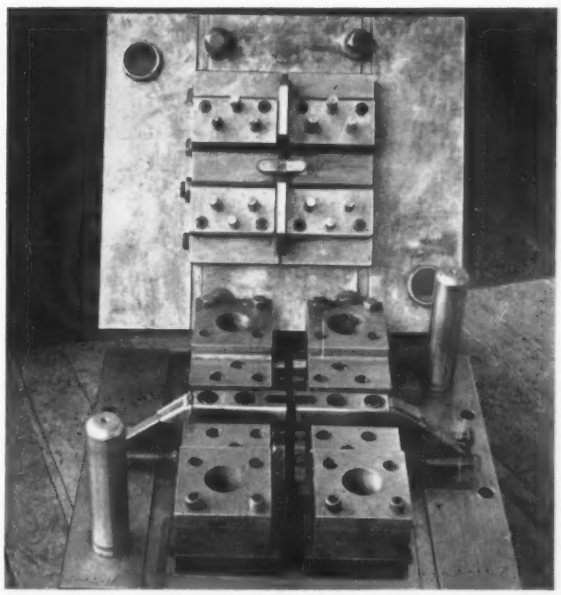


BTR is our general-purpose, manganese-chromium-tungsten grade of oil-hardening tool steel, perhaps best known for its safe hardening property. It also has good abrasion-resistance and toughness, and is ideal for practically every application where long wear is desirable.

If you would like to give BTR a workout in your shop just put in a phone call to your Bethlehem tool steel distributor. You'll find him well stocked with BTR, and anxious to be of service to you.



Assortment of screw drivers made by Oxwall Tool Co., Ltd. Each blank is winged by a die of BTR tool steel, for firm anchorage in handle. Model shown in illustration at the upper right, with flexible shaft which can be bent as needed, is an ideal time-saver for cramped quarters.



SHOCK-RESISTANCE PAYS OFF AS DIE MADE OF 67 CHISEL PUNCHES HOLES IN HIGHWAY GUARD RAIL

Because of its excellent shock-resisting properties, this die of Bethlehem 67 Chisel tool steel provides economical punching of bolt holes in beam-type highway guard rail. The die, hardened to Rockwell C-51, operates in a 200-ton press. In addition to its shock-resistance, 67 Chisel is wear-resistant, making it ideal for such applications as shear blades, hot-work tools, blanking tools and swaging dies.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Here's How to Harden Tools with Holes

Ordinarily holes in tools cannot be eliminated. Nor can their size or location be changed, in most instances. So steps must be taken to control the ill effects of holes, such as tools cracking during the hardening operation. Although it is impossible to outline a procedure for all tools, the following principles are recommended for those containing holes:

1. Quench tools so that the internal surfaces of the tools harden completely. When holes are relatively large, no special attention may be necessary; for small holes, flush-quenching may be required.

2. If it is possible that effective quenching may not occur completely throughout the holes, pack them so that hardening cannot take place in the holes, assuming that this condition is allowed on the tool. Use clay, asbestos, steel wool or steel inserts.

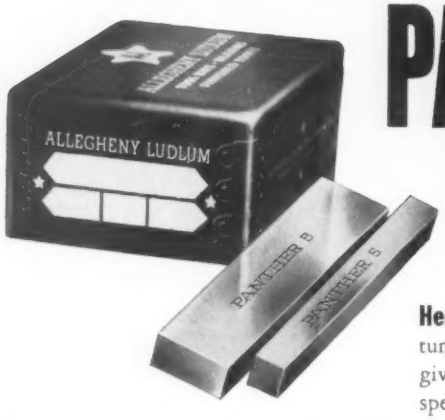
3. If only the surface of a hole is to be hard, as on a ring die, flush-quench the bore while protecting the outside surface from the quench.

The internal surface of a hole should be either uniformly hard, or uniformly soft. The worst possible condition is an irregular hardness pattern on the inside surface, because the high stress developed may result in cracking.

TRY and COMPARE

PANTHER 5 TOOL BITS

FOR YOURSELF



Here's what you GET in Panther 5 . . . A high-carbon, high-vanadium, tungsten-bearing high speed steel with 5% cobalt. Its analysis is designed to give this grade the highest red-hardness and abrasion-resistance of *any* high speed steel.

Here's how it can HELP you . . . This combination of highly valuable properties gives Panther 5 exceptional ability to resist wear, yet it also possesses good toughness and edge strength. Put Panther 5 Tool Bits on your heavy-duty jobs and abrasive materials—*watch them step up your production runs between grinds!*

Stocked in ALL SIZES . . . Panther 5 Tool Bits are produced as a finish-ground product. They're carried in stock for immediate shipment in nine sizes of squares, from ¼″ x 2½″ long to 1″ x 7″ long . . . and in eighteen sizes of flats, ranging from ⅜″ x ¼″ x 3″ long to 1½″ x ¾″ x 7″ long. ● *Why not get in a trial order—see for yourself what they'll do!* Check your nearest AL representative or distributor . . . or write ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

Valuable Data for
PRODUCTION MEN
. . . yours for the asking

1. **"HIGH SPEED TOOL BITS"**
Handy data on the complete AL line, comprising eight different grades of high speed steel tool bits. Includes shop handling, heat treat methods, etc.

2. **"CUTTING TOOL MATERIALS"**
This 36-page booklet analyzes and compares all AL grades of cutting tools: carbon and high speed steel, cast alloy and carbides. Includes data on handling and treatment.

ADDRESS DEPT. M-66

For complete **MODERN** Tooling, call
Allegheny Ludlum

AL® FINE TOOL STEELS SINCE 1854

WAD-5584

For more information on products advertised, use Inquiry Card, page 277

Crane wheels are one of the many types of products made from Bethlehem blanks. Here a wheel, bearing, axle, and coupling are being assembled at the plant of Whiting Corporation, builder of high-quality industrial machinery.

How to be sure of high strength in a circular forging

Strength is often the very first requirement in a heavy-duty circular part. Bethlehem forged-and-rolled circular blanks give you consistently high strength, *without excessive weight.*

How is this done? The answer lies in Bethlehem's unique process of manufacture. The steel blanks are not just forged, not just rolled, but *both* — in a most unusual mill that combines the steps as a single operation. The mill is thus able to produce a uniform product — one so strong that customers can often specify lighter blanks than they formerly used.

Bethlehem forged-and-rolled blanks are used in gears, crane wheels, industrial wheels, turbine rotors, clutch and brake drums, sheave wheels, flywheels, tire molds, pipe flanges, and many other circular products. The blanks are available in sizes from 10 to 42 in. OD and can be furnished either heat-treated or untreated. For further details, ask for a copy of illustrated Booklet 216; it will be sent to you promptly without cost or obligation of any kind.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

WHY ZINC RATES FIRST IN DIE CASTING • NUMBER 3 OF A SERIES

castability — as utilized by PHILCO

These components of the 1955 Philco Roastmeter electric range reveal the wide design latitude possible with ZINC die castings. No other metal or method of production offers product engineers equal freedom of expression with respect to shape, detail and finish.

Consider, for example, two of the castings—the clock face and frame. Not only are these ZINC die castings extremely complex in shape, but the lettering and numerals (both recessed and raised) are sharply defined and the casting surfaces are ready for either plated or painted coatings.

While these attributes of ZINC die castings govern the appearance of the finished product, they also have a decided influence on production costs. The complexity of shape and clean-cut design details minimize the need for secondary operations. And the smooth as-cast surfaces of these ZINC die castings easily take and hold any commercial finish.

Other examples of product engineering with ZINC die castings will be covered in future advertisements in this magazine. Send for our brochure and contact any commercial die caster for the answers to your particular production problems.

Send for your copy

The New Jersey Zinc Company 160 Front St., New York 38, N. Y.

ZINC
FOR DIE CASTING ALLOYS

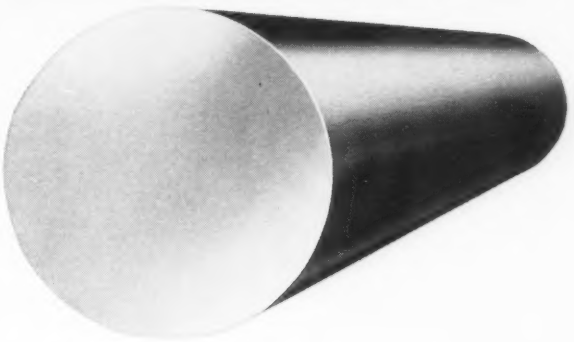
The Research was done, the Alloys were developed, and most Die Castings are based on

HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

For more information on products advertised, use Inquiry Card, page 277

When you make hollow parts . . .

Why use bar stock?



start with seamless tubing

Save steel, machining time!

WHY bore out bar stock to make hollow parts when Timken® seamless steel tubing lets you start production with the center hole already there? You don't waste steel and you save machining costs, too. Finish boring is often your first production step. Screw machine stations can be released for other jobs. So you add machining capacity without adding machines. And you save money because you pay only for the steel you use.

Our engineers will save you even more money, too, by studying your problem and recommending the most economical tube size for your hollow parts jobs, guaranteed to clean up to your finished dimensions.

You also get fine forged quality in Timken seamless steel tubing. The piercing process by which it is made is basically a forging operation.

It gives the tubing a uniform spiral grain flow for greater strength, and a refined grain structure which brings out the best in the quality of the metal. The Timken Company's rigid quality control keeps this quality uniform from tube to tube and heat to heat. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD — THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

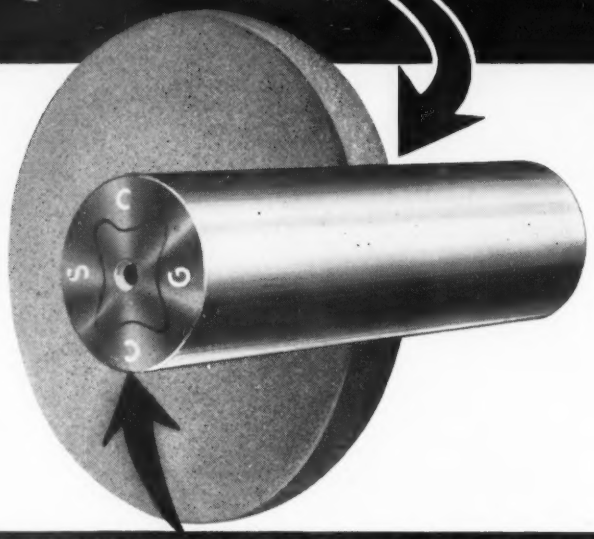
An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,

smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000± Min
Potomac Brand—AISI C-1040, Elastic Limit 45,000± Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000± Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

For more information on products advertised, use Inquiry Card, page 277

Let New Britain engineering supply a new approach

A machine is listed as an asset on your balance sheet, but if it slows your production and makes your costs too high, it's an asset you can't afford.

We invite you to call in your New Britain representative for a new approach to turning out the pieces that affect your profit margins. He has one of the broadest lines in the industry to choose from.

The following four pages contain examples of New Britain's New Approach.

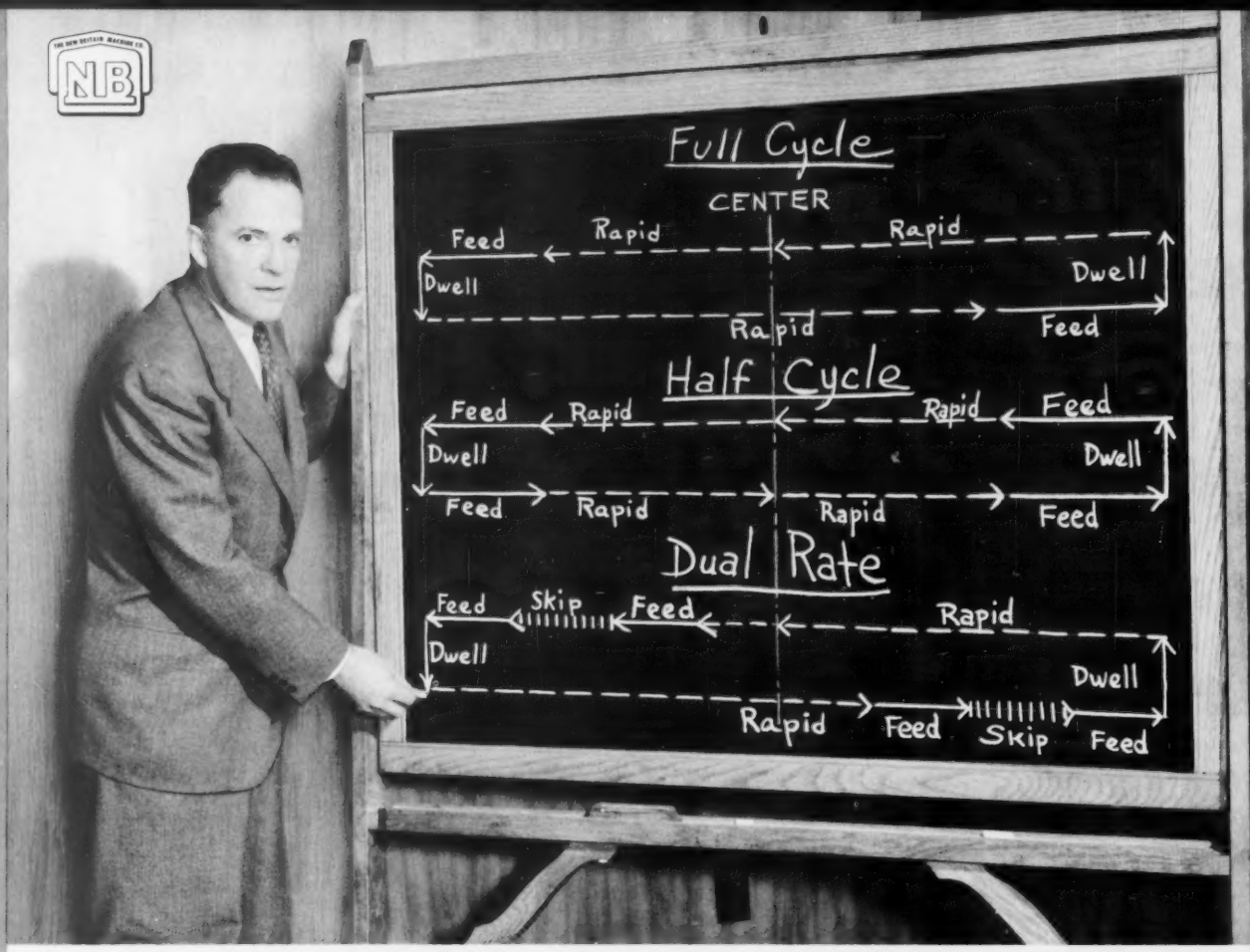
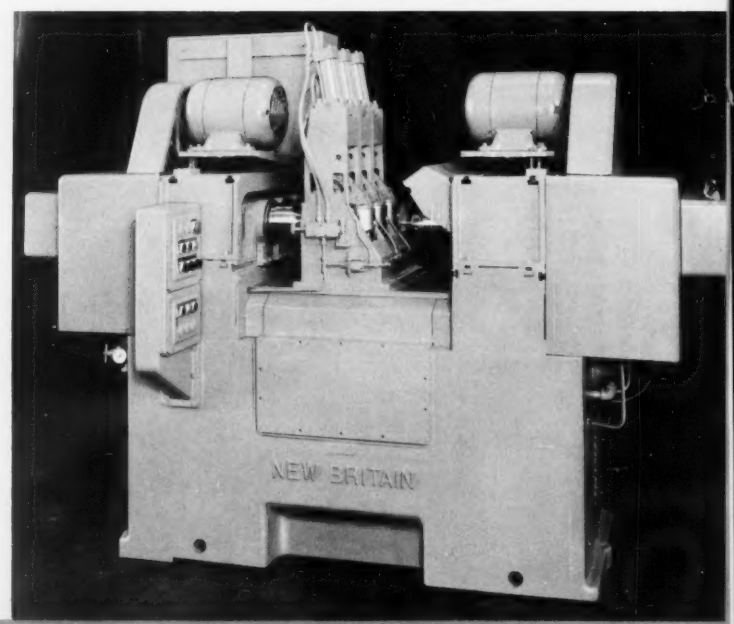


Diagram of versatility

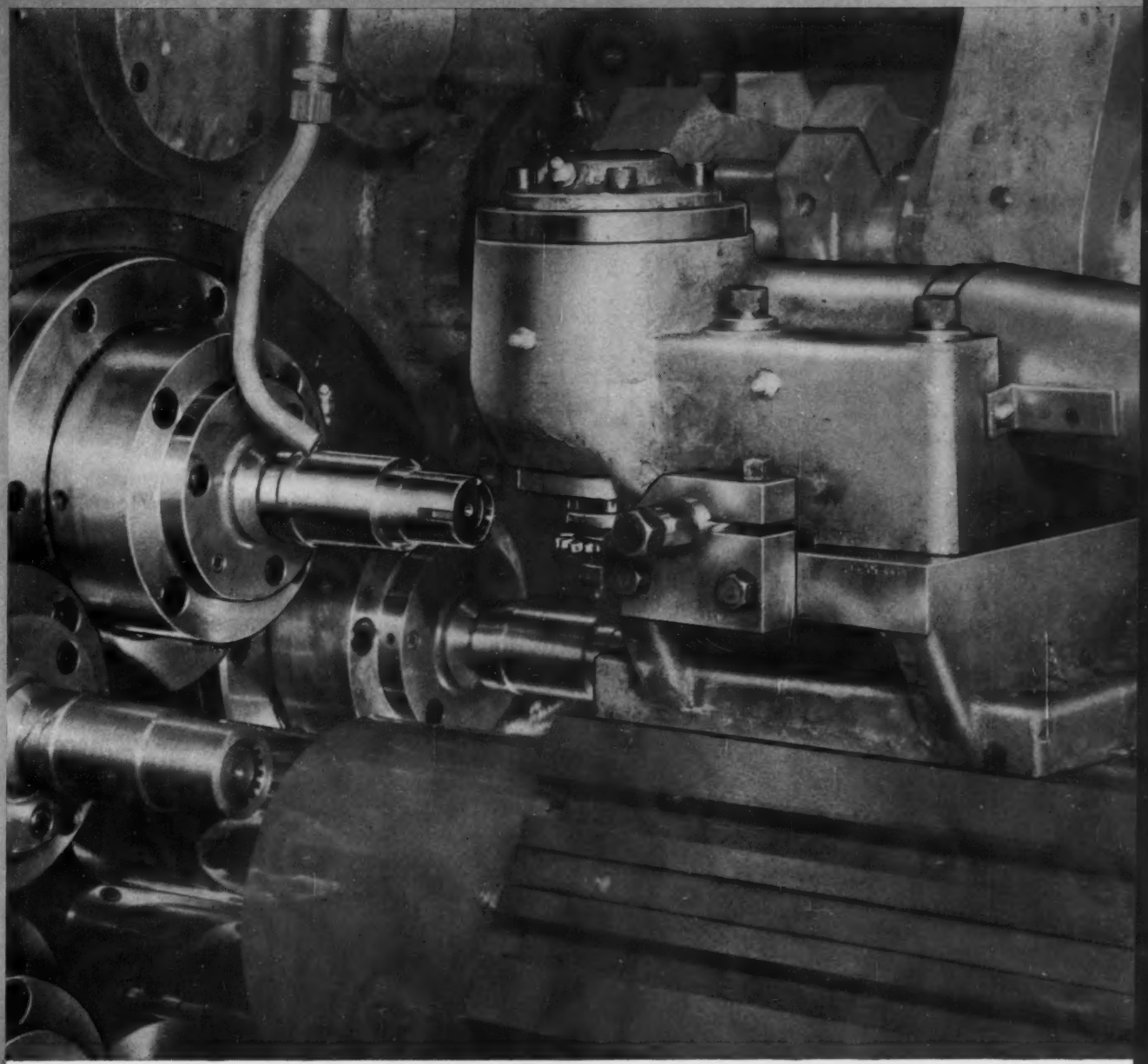
New Britain engineers can show you how to get two pieces per cycle (or double-end production) because of the flexibility of cycling they have designed into our double-end precision boring machines. The blackboard sketches show only three of many set-up possibilities.

FEATURES:

- **Completely separate hydraulic unit outside machine frame**
- **Automatic re-cycling or manual operation**
- **New Britain precision boring spindles**
- **Variable feed during cutting cycles**
- **Special fixtures and work holding devices**
- **One to four spindles at each end**
- **Tool or work rotating**
- **Coolants (optional)**



Model 50 New Britain Double-end Precision Boring Machine



The best machine is only as good as the engineer who tools it

How imaginative tooling can save time and money

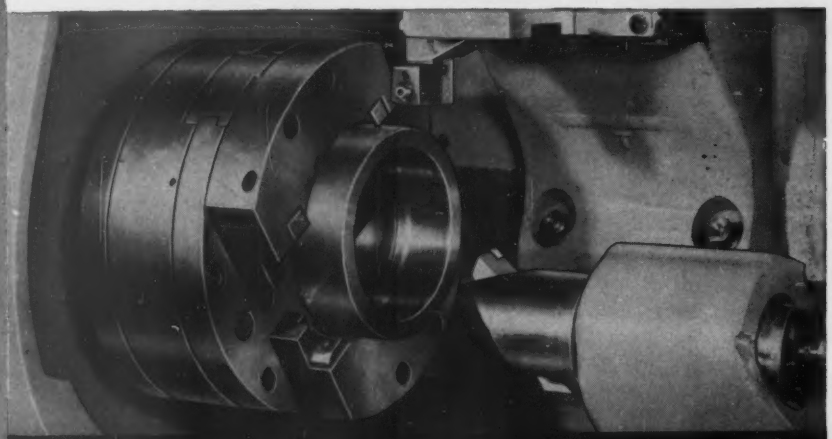
Skillful application of engineering principles to perform secondary operations on one machine can work wonders on *cost-per-piece:* Compare the cost of this milling attachment with the cost of a separate milling machine, *plus operator, plus overhead, plus maintenance, plus transfer time.*

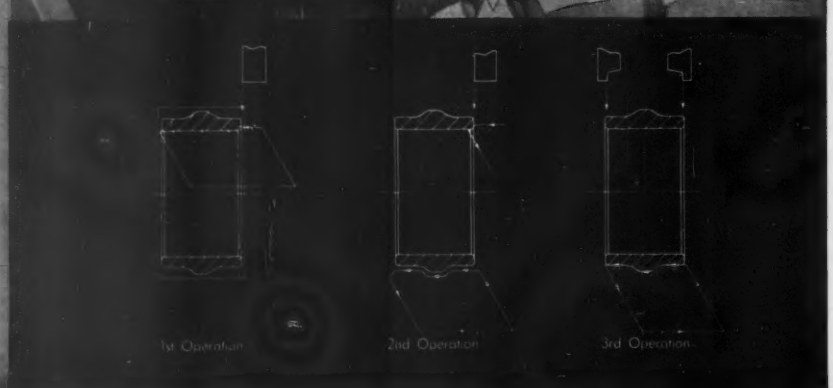
Opportunities like this for lower cost-per-piece exist in almost every plant, if you look for them. New Britain engineers are trained specialists, ready to cooperate in finding better methods.

See preceding two pages and two following pages for other New Britain *New's.*

New approach to bearing races

Single point turning on a New Britain +GF+ copying lathe





- **Three New Britain +GF+ lathes replace four other machines**
- **No costly form tools to buy and maintain**
- **Change-over time reduced 90%**
- **Total job time cut more than 50%**
- **Savings quickly pay for new machines**

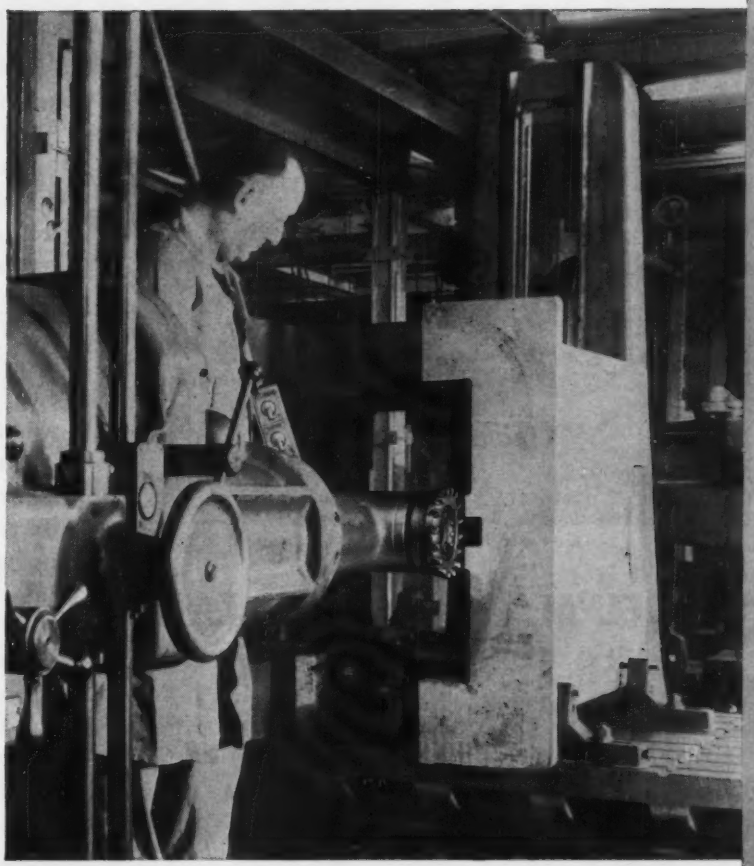
Easy way to learn about the New Britain +GF+ copying lathe

Ask your New Britain representative for a showing of the color motion picture "A NEW APPROACH TO COPY TURNING" in your own plant. Or write The New Britain Machine Co., New Britain, Conn.

The NEW BRITAIN

Lucas attachment produces better finish in a fraction of former time

LUCAS OF CLEVELAND

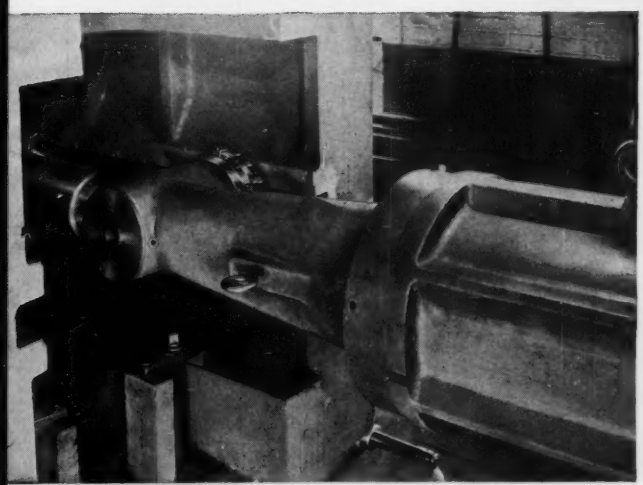


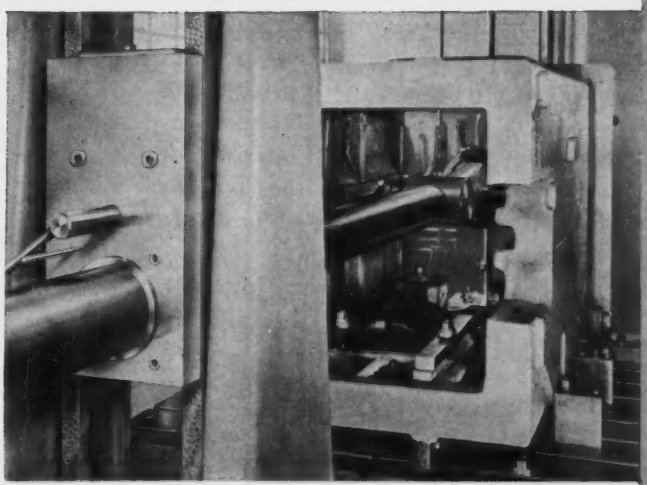
This Lucas Precision Horizontal Boring, Drilling and Milling Machine with angular milling attachment faces two opposing surfaces of this large casting with extreme precision. It machines both sides of the work with a simple 180° repositioning of the cutter — without resetting the job, or loss of accuracy.

Performing these fine finish operations with the cutter over *four* feet away from the front bearings of the machine is an extreme test, but there is no chatter, and this job has been running for four years to the manufacturer's complete satisfaction.

Ask your Lucas representative for help on the jobs other horizontal boring mills can't handle.

LUCAS MACHINE DIVISION
The New Britain
Machine Company
Cleveland 8, Ohio





• AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
• LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES • NEW BRITAIN +GF+ COPYING LATHES

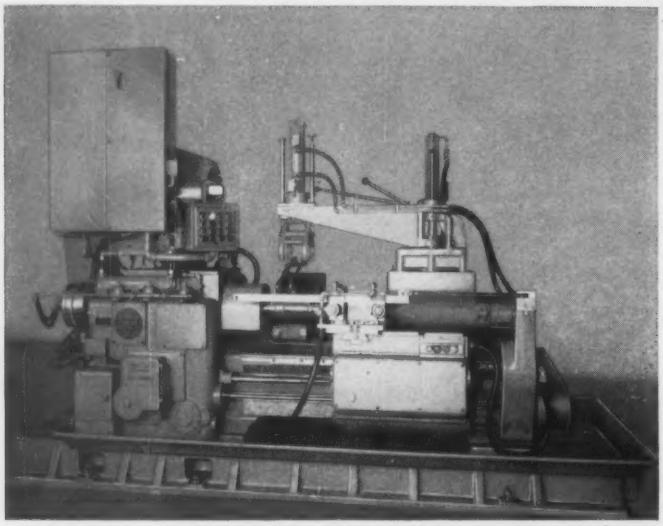
MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut
Lucas Machine Division, Cleveland 8, Ohio

See the preceding four pages for other New Britain New's.

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK



MODEL AP *Lo-swing* LATHE SPEEDS MACHINING OF 155mm SHELLS

PROBLEM: To finish turn ogive and copper band on 155mm shells.

SOLUTION: A Model AP Lo-swing Lathe, tooled as illustrated, was selected for this job since its rack and pinion carriage feed permits any length of feed within the capacity of the bed. This feature was particularly advantageous because of the exceptional length of the nose of the shell and overlapping of multiple tools was not permitted.

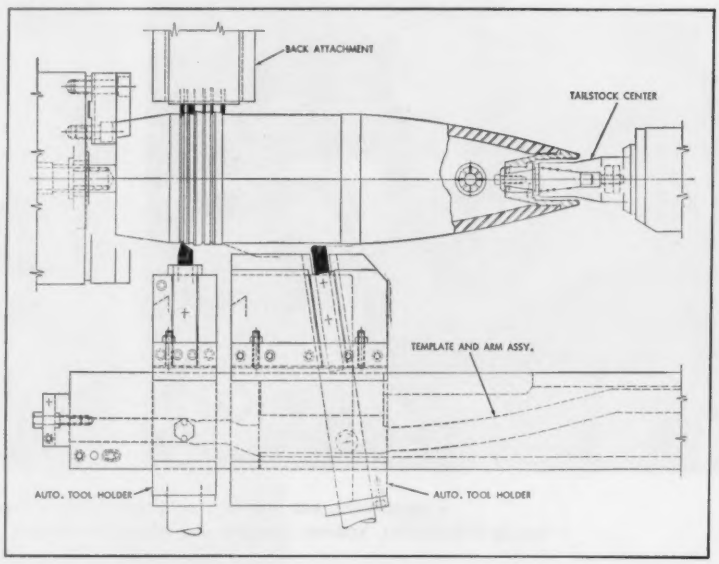
For this particular operation, the machine, which is basically a semi-automatic lathe, was equipped with a full automatic cycle. The operator simply loads and unloads the shells with the pneumatic loader and pushes the starting button. The spindle stops automatically at the end of the machine cycle with the carriages and tools returned to the starting position.

The spindle drive is through a variable speed electric motor with an automatic control mechanism which maintains a constant cutting speed over the full length of the ogive. This is important, as the nose of the shell must have a fine, smooth and polished surface, which is obtainable only with a constant cutting speed. Production is also improved when a constant cutting speed is maintained.

The line drawing shows the tooling designed for this job. The piece is held and driven with a three-jaw, air chuck and supported on the tailstock end with an expanding collet. The front template which controls the form of the ogive and the copper band is clearly shown as well as the automatic back squaring attachment which carries the grooving tools.

Production is 44 shells per hour at 100% efficiency. Bring your turning problems to Seneca Falls.

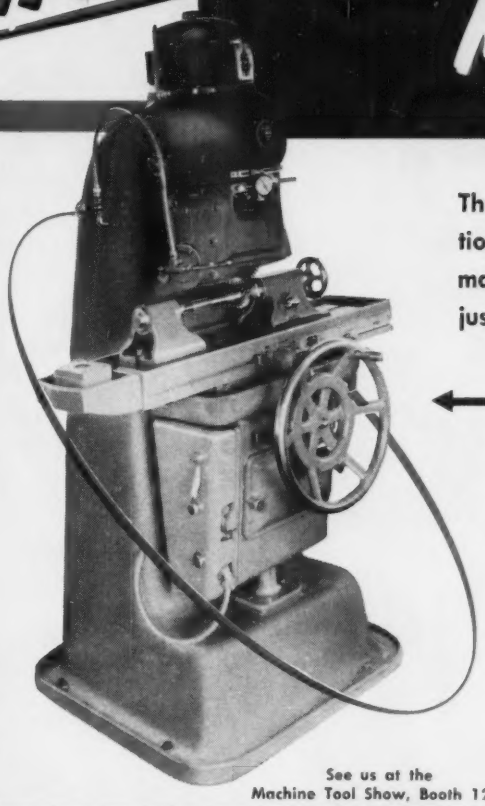
SENECA FALLS MACHINE CO., SENECA FALLS, N.Y.



THE MACHINE TOOL SHOW CHICAGO, ILL.

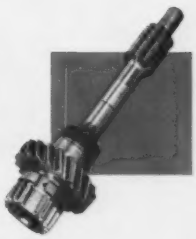
PRODUCTION COSTS ARE LOWER WITH *Lo-swing*

NOW IS THE TIME TO Cut Manufacturing Costs

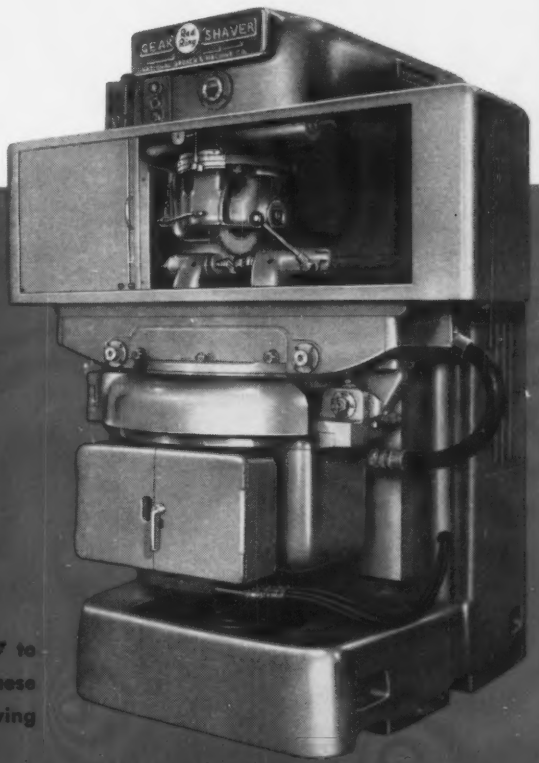


The one sure way of meeting today's competition is with today's machine tools. The older machines were all right in their day but they just haven't got what it takes now.

← **For instance,** it took this old Red Ring Model GCC 60 seconds to shave a gear like the one shown. →



See us at the Machine Tool Show, Booth 1215



Model GCU today finishes that same gear in just 16 seconds—and to much closer tolerances, too.

In an 8 hour day the GCU will deliver 375% of the production of its predecessor.

Write for Bulletin S 53-7 to get all the facts on these new cost saving gear shaving machines.

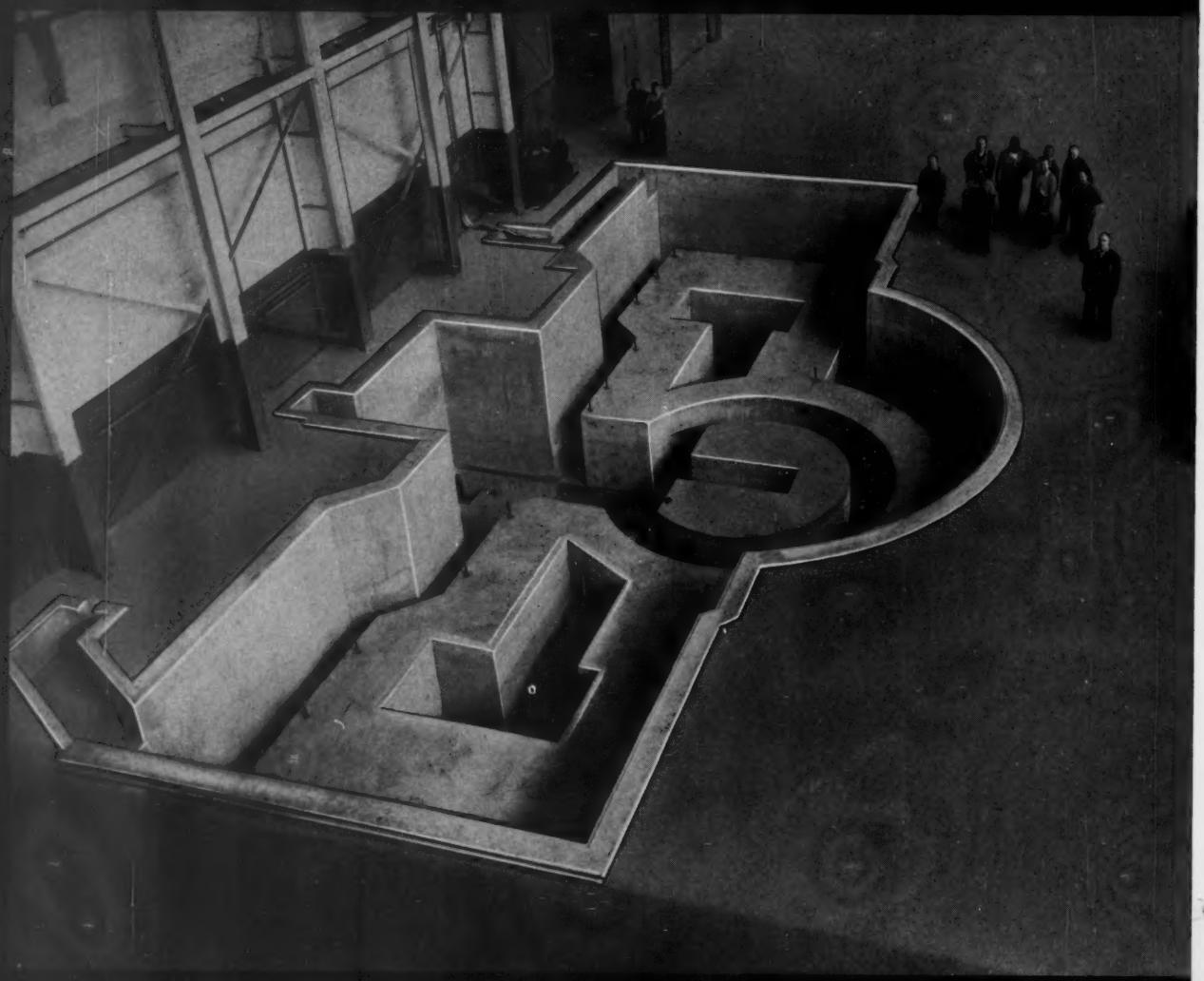
6972

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Now You Can

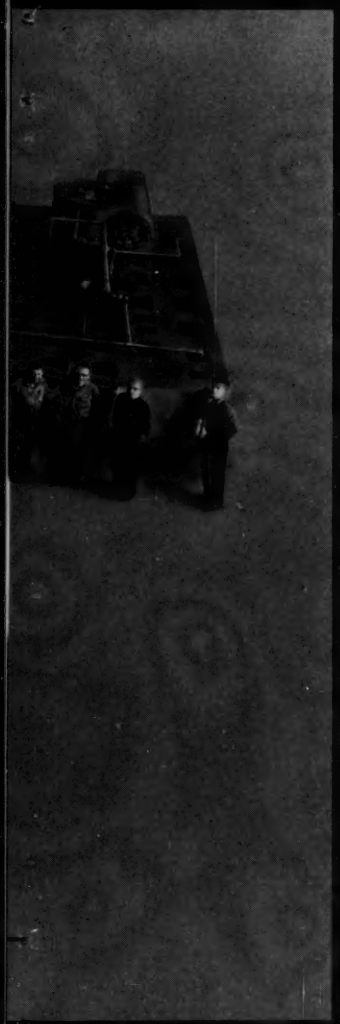


Foundation for the Betts 42 foot Vertical Boring and Turning

CONSOLIDATED MACHINE TOOL

A DIVISION OF FARREL-

Build Them BIGGER!



Mill

The size of the equipment in your own shop need no longer limit the size of the products you build.

Consolidated is completing a two million dollar shop expansion program that will make some of the world's largest machine tools available to you for your own big work.

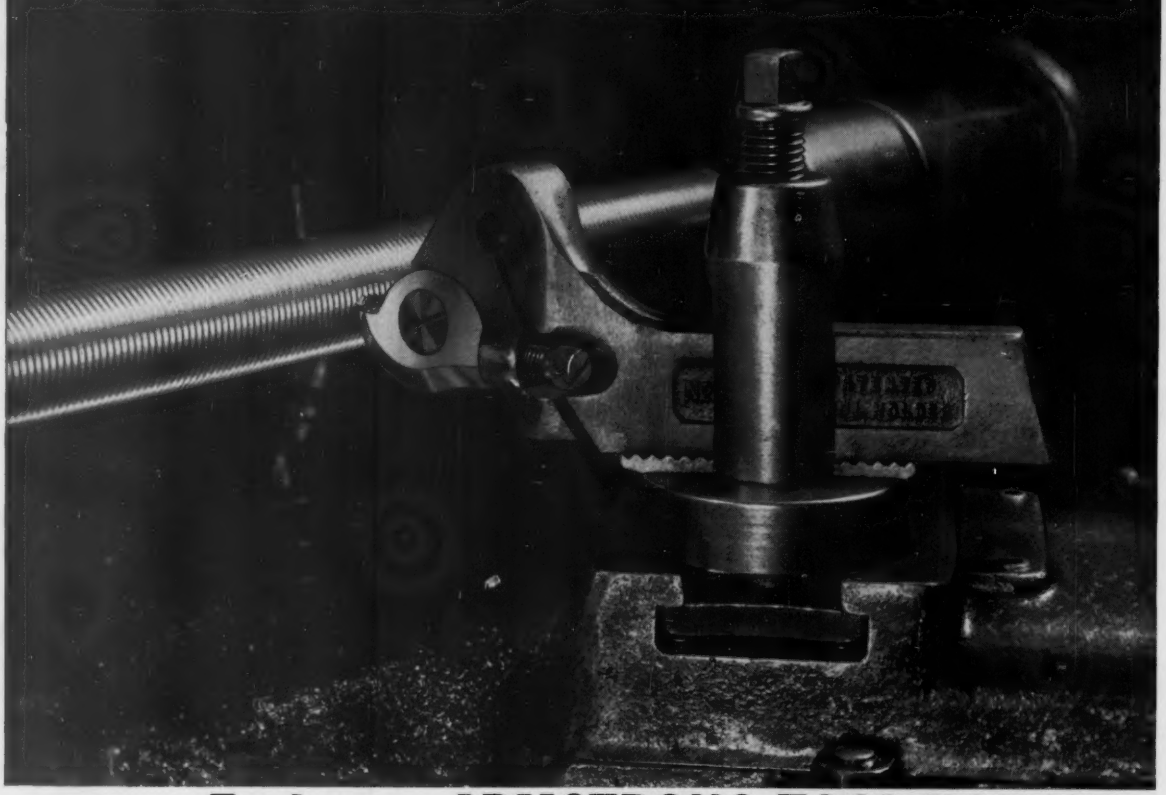
This program includes a Betts 42-foot Vertical Boring and Turning Mill, a Betts 96-inch Lathe with 50 feet between centers, a Sellers 10-inch Floor Type Horizontal Boring and Milling Machine with 12 feet of head travel on the column and 25 feet of column travel on the runway. The two new cranes in this big shop have a combined lifting capacity of 150 tons.

This equipment with Consolidated's other big tools and skilled workmen are available to you. You can now build your own products larger and we will help you do it.

COMPANY, ROCHESTER 10, N. Y.

BIRMINGHAM CO., INC.

ARMSTRONG



The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

Each year ARMSTRONG TOOL HOLDERS become more important to you

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market . . . are used by over 96% of the machine shops and tool rooms . . . are carried in stock for your convenience by all industrial distributors of consequence.

Buy **ARMSTRONG TOOLS** from your Industrial Distributor

Write For Catalog

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

For more information on products advertised, use Inquiry Card, page 277

Black Light and Tap Life

Black light enables our engineers and inspectors to literally "see in the dark". Focused on a magnetized tool flooded with a fluorescent solution, it permits the operator to *see* cracks or other surface imperfections not otherwise observable.

This equipment is just another safeguard in the research and quality control programs conducted at GREENFIELD, enabling us to make on-the-spot checks of the performance of new materials or new heat treating cycles, and to give 100% inspection *plus* of tools under test.

Greenfield TAP AND DIE CORPORATION, GREENFIELD, MASSACHUSETTS

If WEAR *is a factor...*

...use VK CARBIDE PLUG GAGES

TUNGSTEN CARBIDE
wire type .016″ to .500″ diameter

CHROME CARBIDE
taper insert type .500″ to 1.510″ diameter

In addition to its regular line of tungsten carbide wire type plug gages from .016″ to .500″ diameter, The Van Keuren Company now offers a new line of chrome carbide taper insert plug gages in the range from .500″ to 1.510″ diameter.

Van Keuren tungsten carbide wire type gages have proved their worth on thousands of tough gaging jobs. The new chrome carbide taper inserts (Carboloy, grade #608*) promise to be equally effective. Wearing qualities of chrome carbide are comparable with tungsten carbide. In addition, the material is lighter than tungsten carbide and has a coefficient of expansion close to that of steel . . . both of which factors are a distinct advantage in the larger sizes.

Finish on Van Keuren gages in either tungsten carbide or chrome carbide will average .5 RMS or better. These gages are available in Class Y, X and XX accuracies at moderate prices and on a reasonable delivery basis.

Send for a copy of the 220-page Van Keuren Catalog and Handbook No. 35 containing valuable technical and engineering information on measuring problems and methods. Address: The Van Keuren Co., 178 Waltham St., Watertown, Mass.

* Trademark of the Carboloy Dept. of General Electric Company.

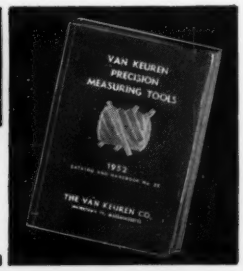
VK

36th Year

THE Van Keuren CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

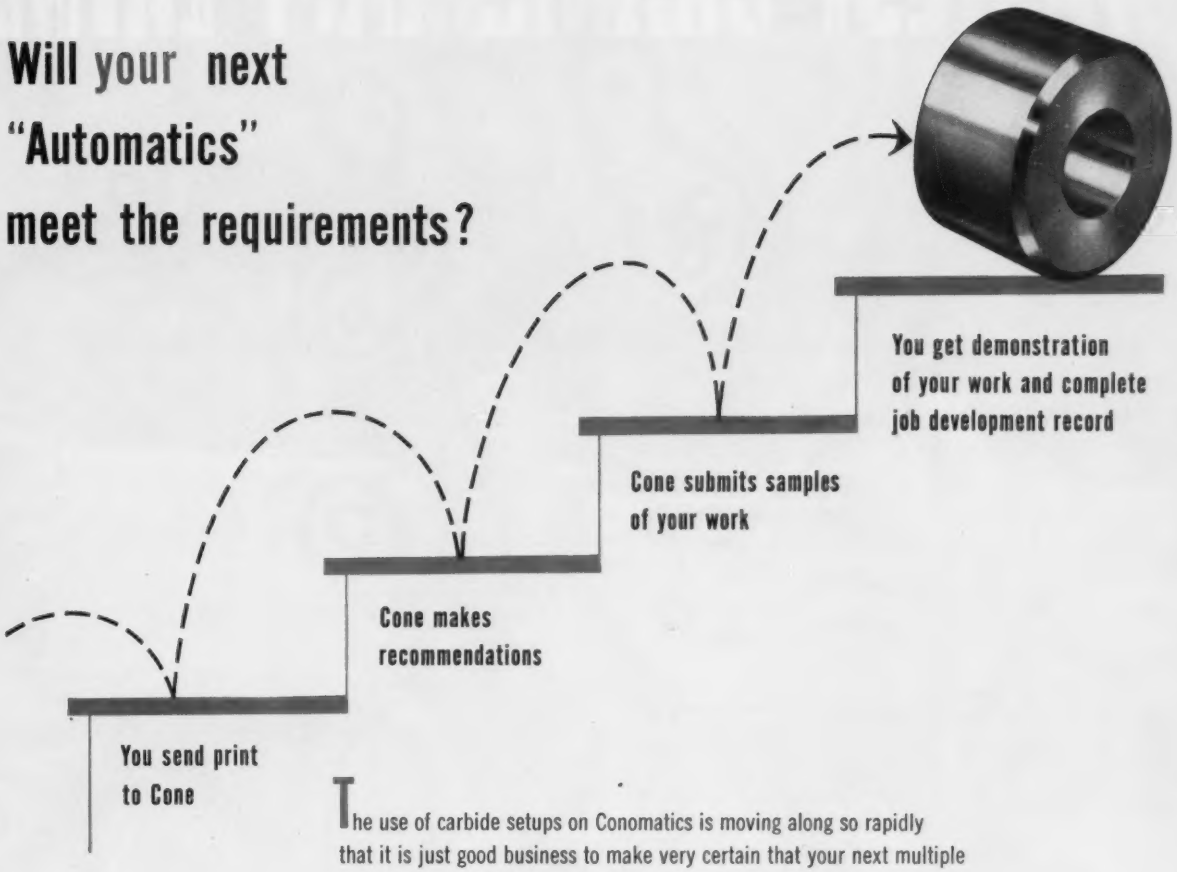
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages



For more information on products advertised, use Inquiry Card, page 277

No. 2 in a series

Will your next "Automatics" meet the requirements?


You get demonstration of your work and complete job development record
Cone submits samples of your work
Cone makes recommendations
You send print to Cone

The use of carbide setups on Conomatics is moving along so rapidly that it is just good business to make very certain that your next multiple spindle automatics will meet 100% carbide tool requirements.

You can be certain by seeing a demonstration of the machine of your choice equipped with carbide tools on your own work. That is, you can if it is a Conomatic.

Without charge, except for bar stock and tools, you can be an on-the-job witness to a carbide test run of your own work on a Conomatic.

And whether you are ready for carbide now, or will be later, you will want to consider a machine that is superior for either carbide or hss.

DATA FOR COMPARISON

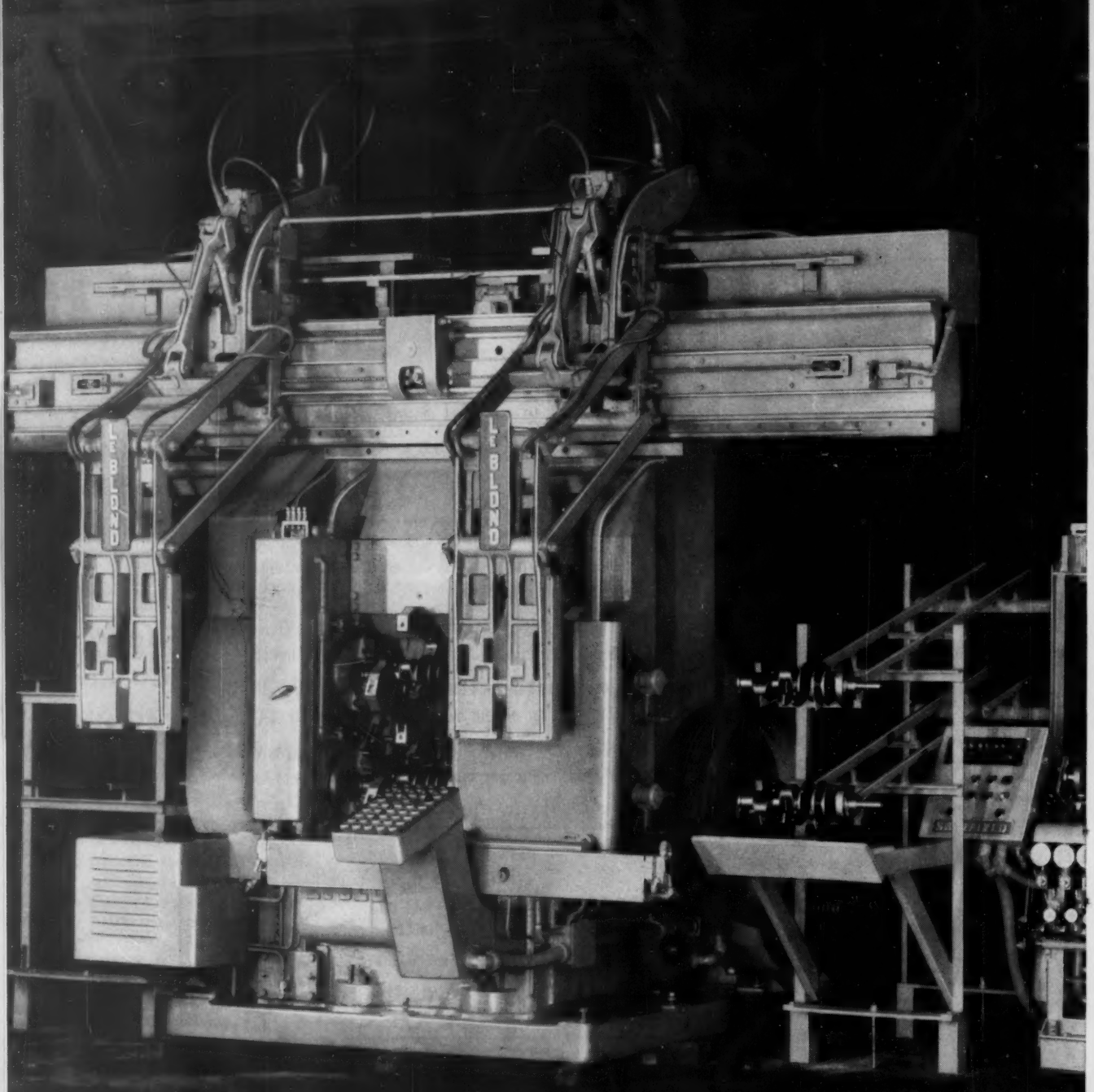
Part ..... Roll	Depth Hole ..... 1 1/32"
Machine .. 1 5/8" Six Spindle Conomatic	Work Dia. ..... 1 9/16"
Material ..... 8620 HR	Drill Dia. ..... 11/16"
Tools ..... 100% Carbide Tipped	RPM ..... 1216 Work Spindle 1040 Op. Drill 2256 Total Eff'd.
Stock Size ..... 1 5/8"	
Length ..... 1 1/32"	Time ..... 10.7 Seconds

Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

FASTEST CRANKSHAFT LATHES



THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 9-17, 1966

Crankshafts travel from right to left. The LeBlond LBA turns main bearings, flange and pilot, sprocket diameter and front end simultaneously. The automatic loader-unloader then delivers the crank to a gaging fixture where diameters of the No. 1, 3 and 5 main bearings are checked. The crankshaft is transferred to the LeBlond PBA where all the pin bearings of two cranks are turned at the same time. Note: Loading racks shown are temporary for runoff only.

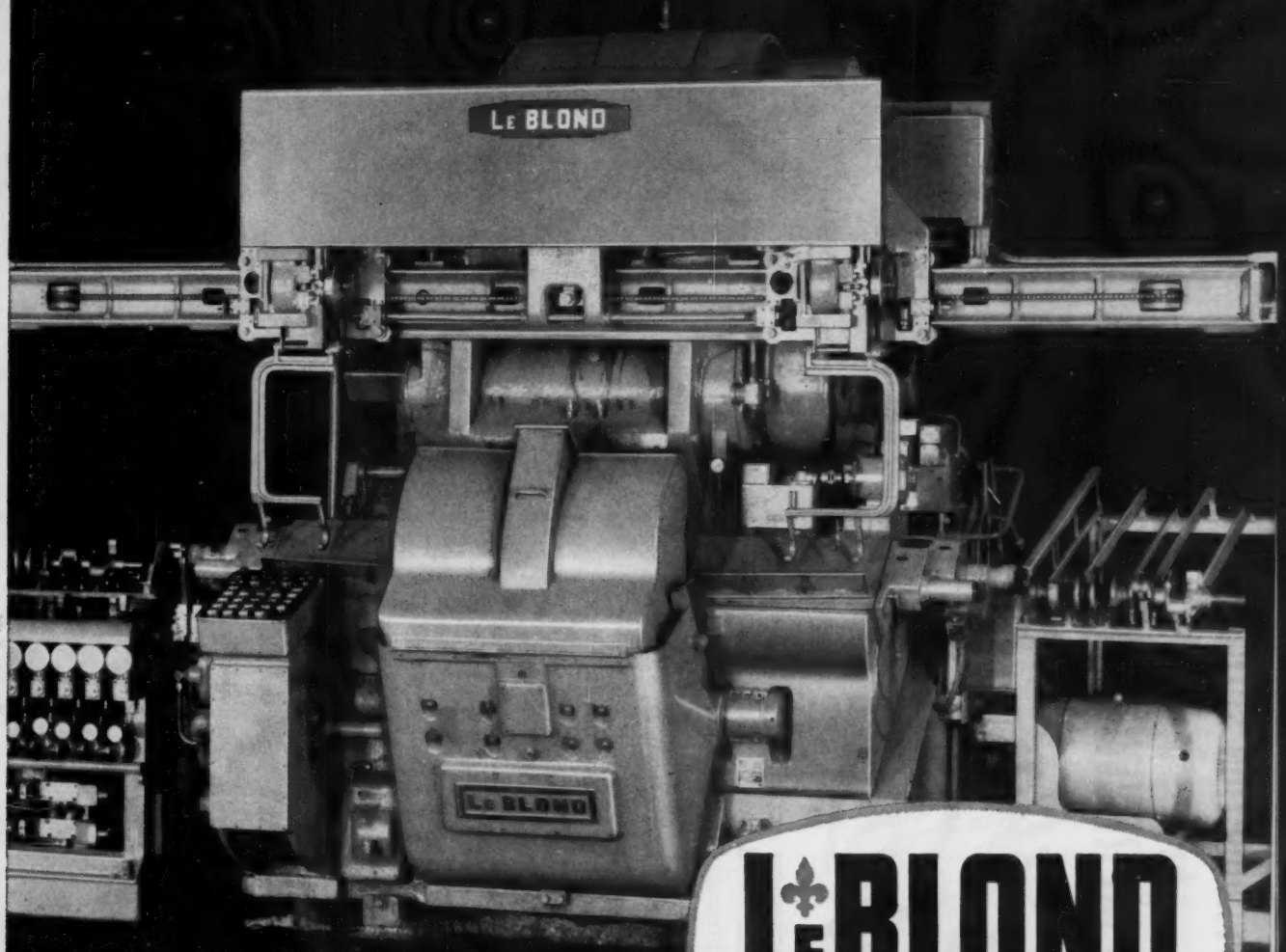
ANNOUNCED BY LeBLOND

Fifty-five precision-cast V-8 crankshafts per hour—highest production yet—are turned out by the latest LeBlond Automated Crank Turning Equipment.

The new unit consists of a LeBlond Automatic Line Bearing Center-Drive Lathe, a gaging fixture and a LeBlond Automatic Two-Spindle Pin Turning Machine. One operator can handle two such units. All turning and facing operations are completed on the crankshafts which have been prepared by spot milling and centering. Machine motions are sequenced electrically and hydraulically for continuous automatic operation.

You can benefit from LeBlond's experience as *the* pioneer of crankshaft-turning equipment over more than a half-century. Send us your crank-turning specifications for quotation.

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO



....cut with confidence

LeBLOND of Cincinnati

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES — FOR MORE THAN 67 YEARS.

Another **PRODUCTION SOLUTION**

by

MOTCH & MERRYWEATHER

Does the Job Best!

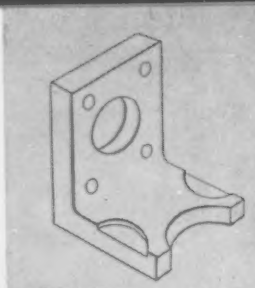
A variety of machining operations, unique in sequence, is combined on a new 15-station automatic transfer machine. Grouping standard machine tool units attains maximum production and utilizes automation. In addition, the M. & M. Triple-Chip circular saw cut-off makes possible the use of low cost stock material; increases your ultimate savings. Start by sending us your part drawings for a production solution by Motch & Merryweather.

THE MOTCH & MERRYWEATHER MACHINERY CO.

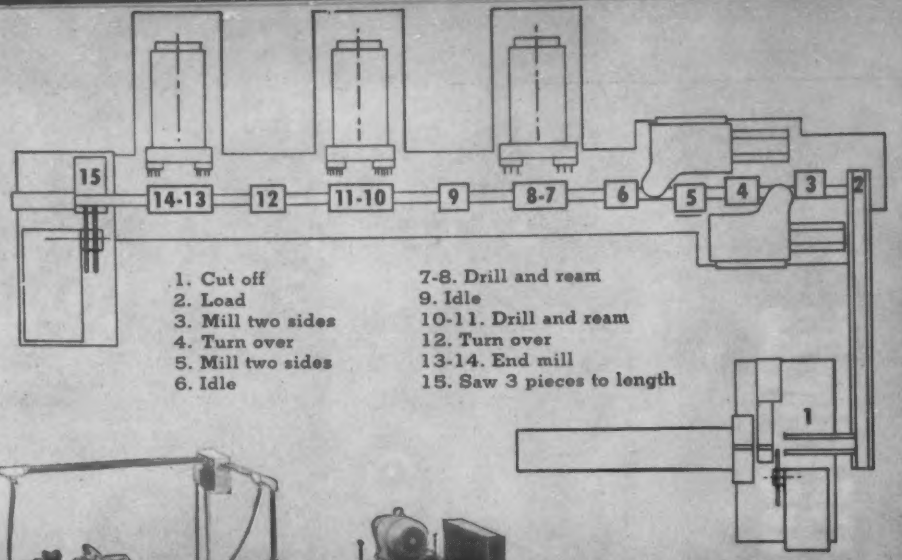
MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

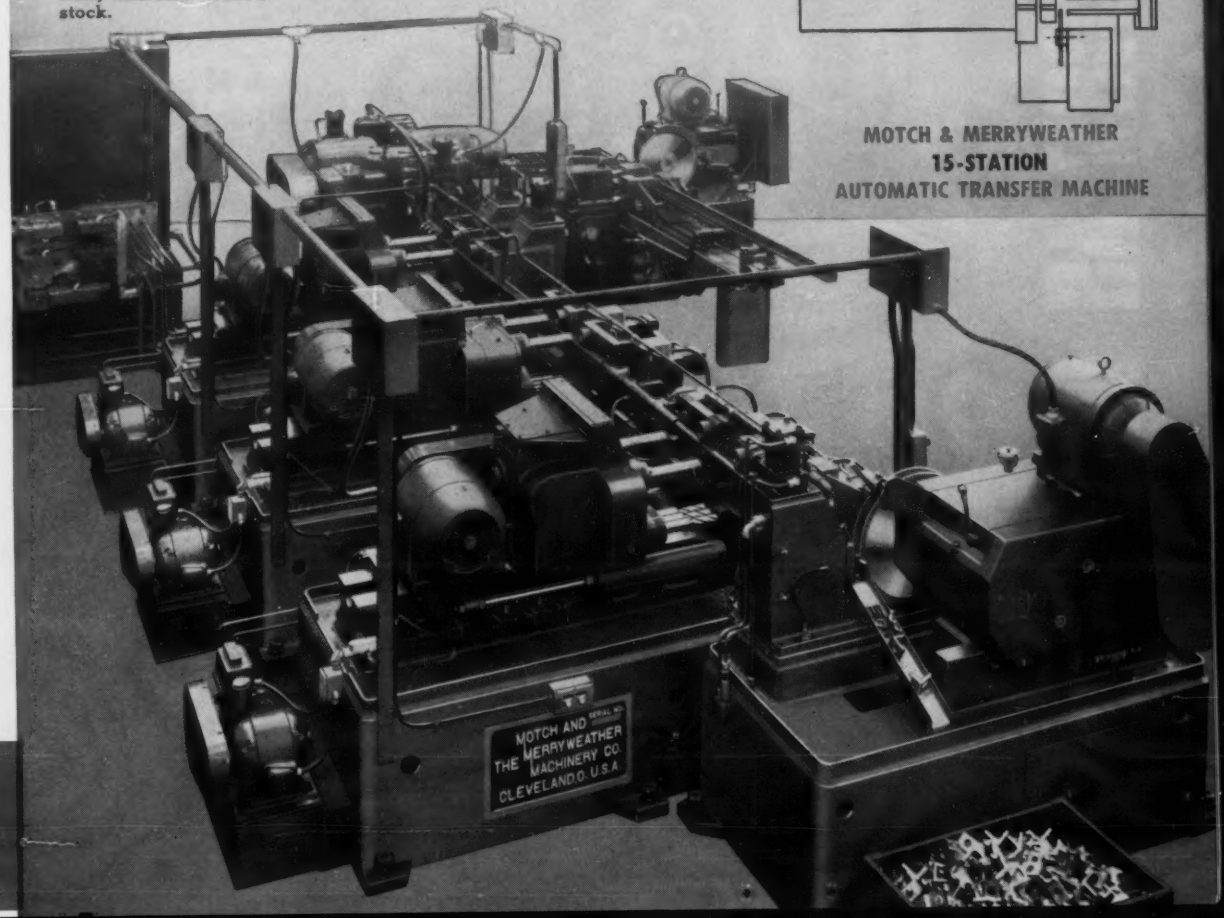
Builders of Circular Sawing Equipment, Production Milling, Automatic and Special Machines



Part Name:
Cylinder bracket.
Production:
384 pieces per hour.
Material:
3" x 2½" x ½" angle iron, standard milled stock.



1. Cut off
2. Load
3. Mill two sides
4. Turn over
5. Mill two sides
6. Idle
7-8. Drill and ream
9. Idle
10-11. Drill and ream
12. Turn over
13-14. End mill
15. Saw 3 pieces to length



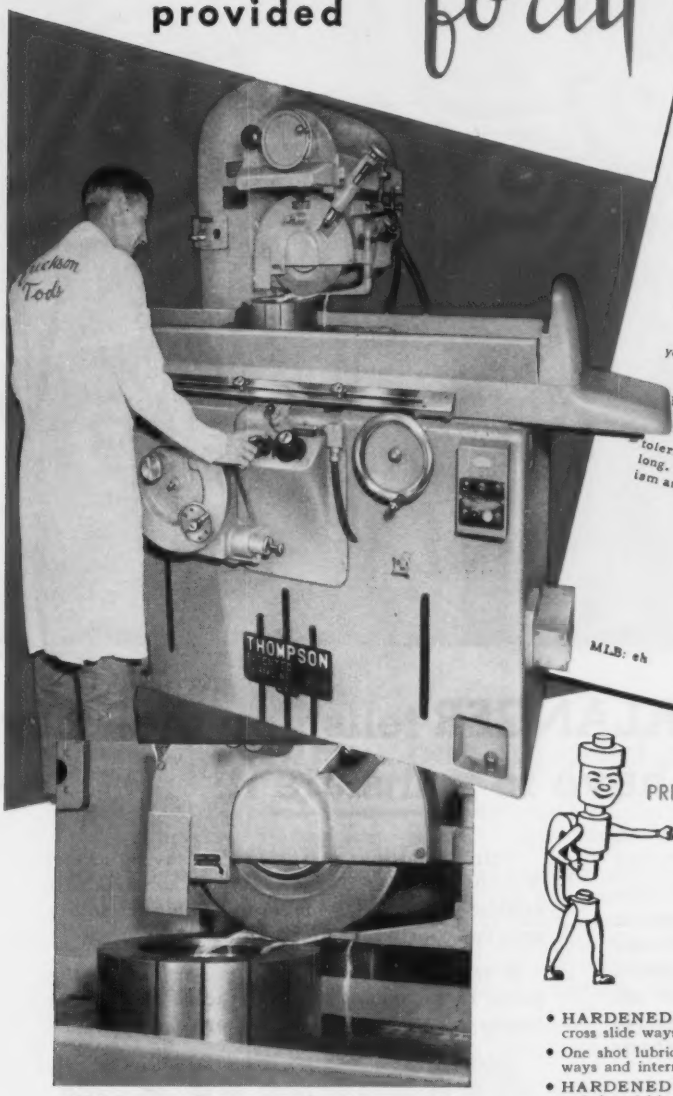
MOTCH & MERRYWEATHER
15-STATION
AUTOMATIC TRANSFER MACHINE

The Erickson Tool Company

asked for at least .0001 for parallelism and size. . .

The Thompson 2F (8x10x24) Super Precision Grinder

provided "forty millionths"



ERICKSON TOOL COMPANY
EAST 55TH AND HAMILTON AVENUE
CLEVELAND 14, OHIO

September 17, 1954

The Thompson Grinder Company
Springfield, Ohio

Attention: Mr. John Wilson,
Vice President.

Gentlemen:

May we take this opportunity to express our satisfaction with your Thompson 2F 8 x 10 x 24 Surface Grinder.

We purchased this grinder on your claim of .0001 for parallelism l size. This tolerance is necessary for most of our work.

Upon its arrival we asked a service man to prove this .0001 tolerance, using 5 blocks on a surface of 4 inches wide by 20 inches long. The test blocks showed .00004 (forty millionths) for parallelism and size. This was well within your guarantee.

Yours truly,

ERICKSON TOOL COMPANY

M. L. Benjamin,
President.

MLB: eh

PRECISION PETE says:

"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

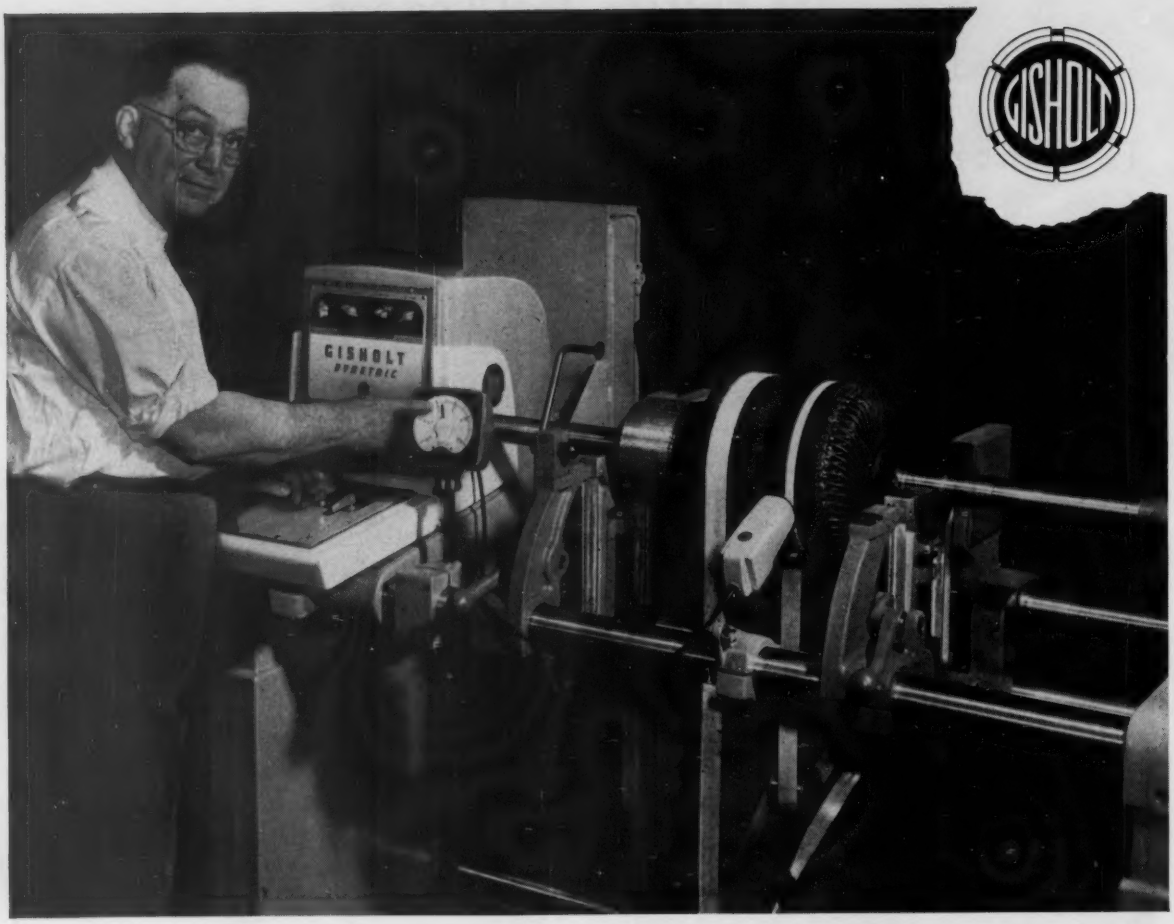
"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."

- **HARDENED AND GROUND** cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- **HARDENED AND GROUND** sealed anti-friction vertical slide.
- **HARDENED AND GROUND BED WAYS** with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
- Elevation micrometer stop graduated in .0001"
- **GROUND THREAD FEED SCREW.**
- Automatic wheel **TRUING** device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

Call, write or wire for estimate

Thompson Grinders

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO



When a GISHOLT BALANCER tells you the story —you don't have to translate it!

Note that dial reading! It does more than you may suspect.

Unlike other balancing machines, it does not merely indicate amount of unbalance in arbitrary units and leave it to the operator to interpret in terms of correction. Gisholt Balancers can tell the story *directly* in terms of correction units. No translation needed. No computation. No charts or graphs.

Because of their infinitely variable sensitivity, Gisholt Balancers are easily adjusted for the job at hand. Correction units such as $\frac{1}{8}$" lengths of wire solder, $\frac{1}{64}$" depths for a certain size of drill, washers of a specific weight, etc., can be used. Readings, in terms of these units, are shown directly on the amount meter.

Think what that means in time saving alone! Yet this is only one of many ways Gisholt enables you to set—and maintain—higher standards for your balancing work.

If your product includes the use of rotating parts, by all means check Gisholt for the most recent information on balancing.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

DYNETRIC BALANCERS GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION
"DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

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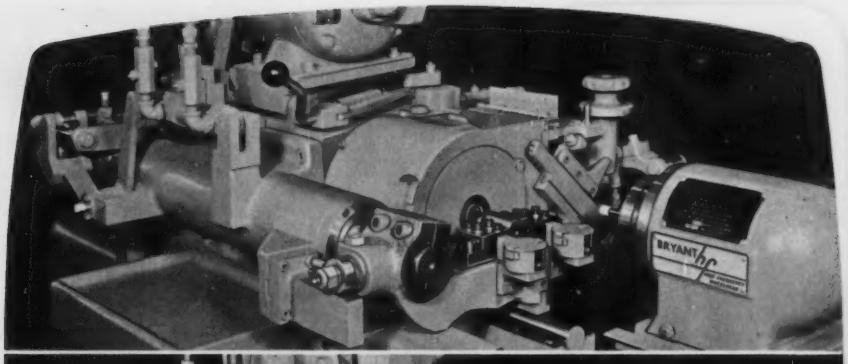
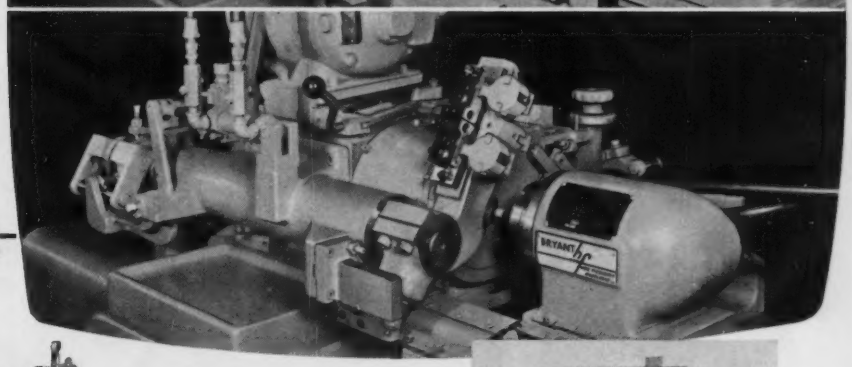
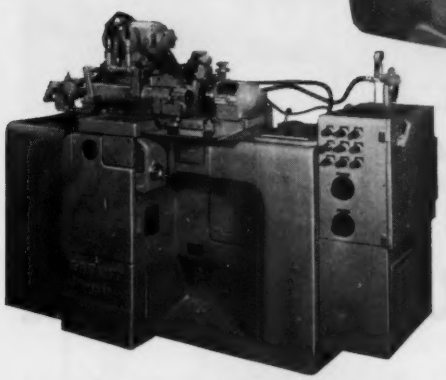
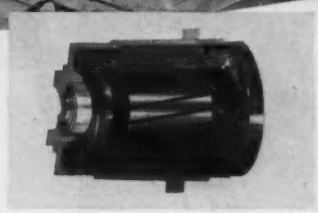
To cut costs and save rehandling-









BRYANT internal grinder . . . combines boring and grinding operations

These photos show how a Bryant Internal Grinder eliminates rechucking of workpieces, resulting in increased production and reduced scrap at Bendix Aviation Corporation's Eclipse-Pioneer Division.

Here, a Bryant model 1209-Y speeds up a fast moving production line by performing both boring and grinding operations on synchro motor housings. Single point carbide tools bore two holes and a face simultaneously in each housing. The grinding operation consists of grinding the stator bore. A fine ground finish is necessary to eliminate possible burrs in the stator slots which could cause failures. Bryant precision alignment assures concentricity held well within the required .0003" tolerance for size, roundness and concentricity. This method has resulted in cutting scrap more than 50% over previous methods used.

Fully automatic Bryant grinders featuring automatic loading and sizing can be readily integrated into your automated production lines. Models ideally suited for tool room and small lot work are also available.

Bryant grinders offer you operating economy – at peak production rates. Their adjustable precision alignment ensures maximum accuracy and minimum maintenance – factors that cut cost per piece.

Write for our free Alignment booklet. Ask, too, for a reservation card for our new sound color movie "Alignment for Better Internal Grinding" – free showings arranged for engineering groups.

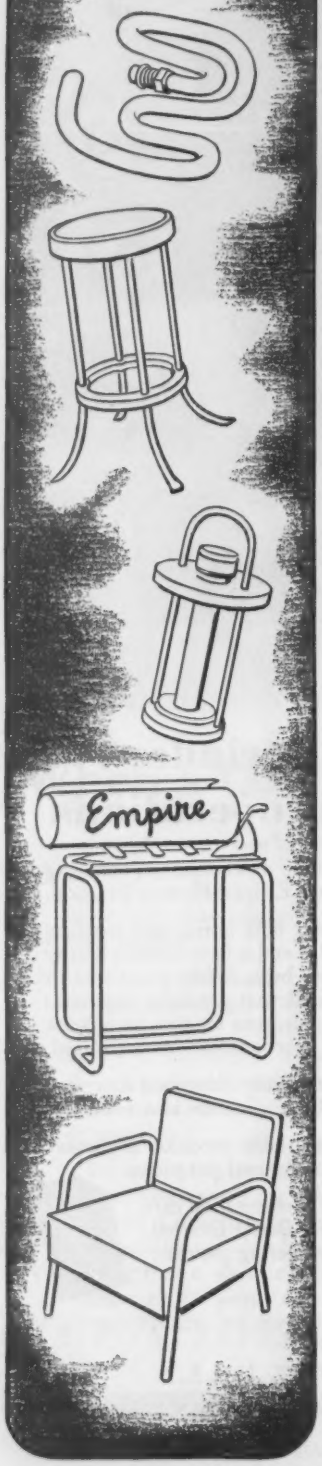
BRYANT chucking grinder co.

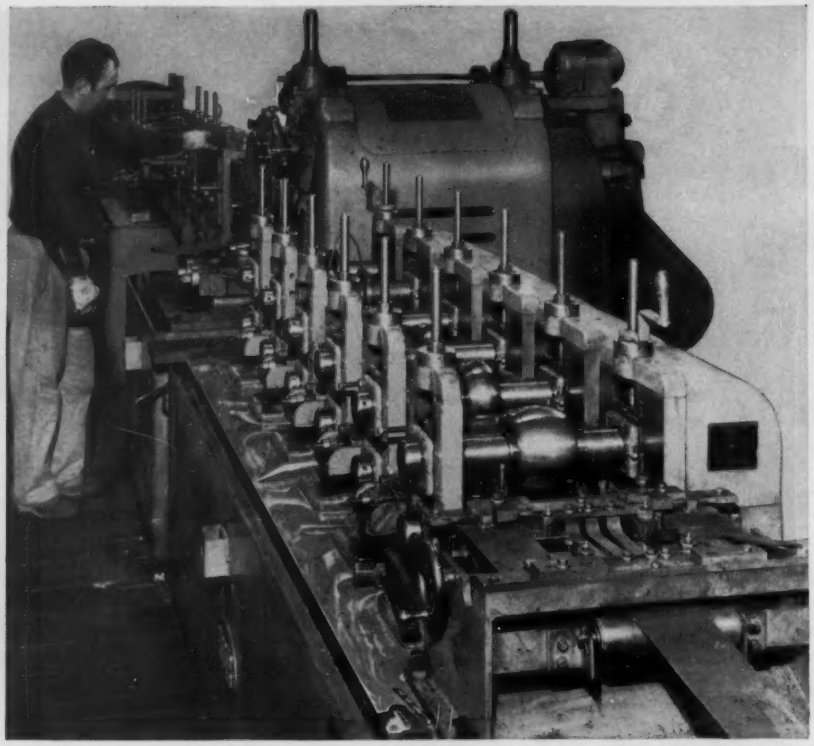
SPRINGFIELD, VERMONT, U.S.A.

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

(Right) Yoder M-2½ Tube Mill installed by James Steel & Tube Co., Van Dyke, Mich. for making tubing sizes from ½" to 2½" o.d., incl.





Plain Facts about
ELECTRIC-WELD TUBE MANUFACTURE

In tube making everybody wants the highest possible speed consistent with good, strong welds and dimensional accuracy. There are, in addition, at least three more essentials to profitable tube making, namely:

1. Low scrap losses—because cost per foot of strip metal is many times greater than the conversion cost.
2. Fine exterior finish, free from scratches, scuff marks and other irregularities which limit usefulness and lower salability.
3. Quick and easy mounting and adjustment of tooling, to reduce time losses between successive production runs.

Yoder tube mills excel in all these respects and have other mechanical, electrical and economic advantages. Because Yoder tube mill owners have found from experience their performance is as good as our promise, there are more Yoder mills sold and in operation than all other electric-weld mills combined. This is as true today as it was ten years ago.

If you want the plain facts about the things to look for in a tube mill, to insure most profitable operation over the years, the new Yoder Tube Mill Book will give them to you, in the simplest language and with numerous illustrations.

A copy is yours for the asking.

THE YODER COMPANY
5504 Walworth Avenue, Cleveland 2, Ohio

ELECTRIC-WELD TUBE MILLS • SLITTING LINES
COLD ROLL FORMING PRODUCTION LINES

INGENIERÍA YODER MANUFACTURA

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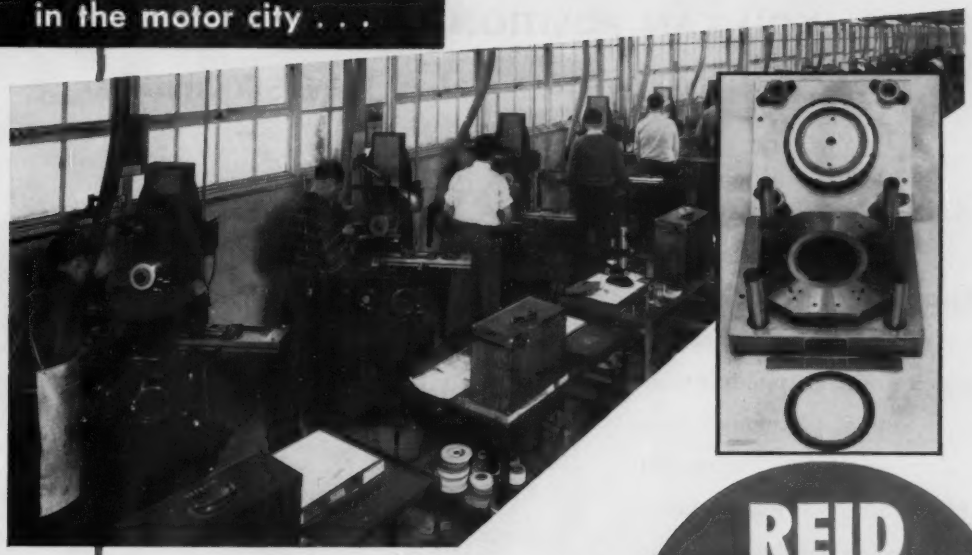
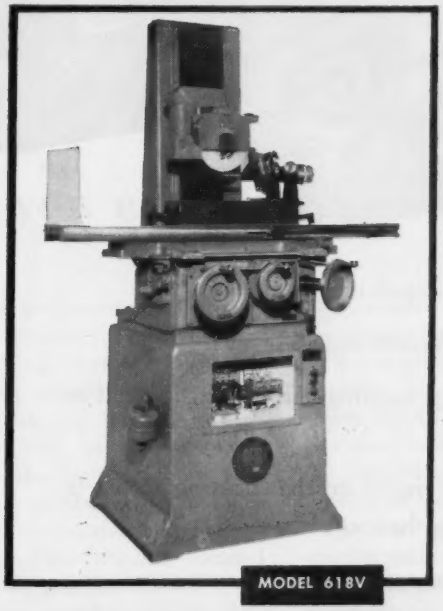
in the motor city . . .



REID GRINDERS set the STANDARD for ACCURACY



MODEL 618V

In Detroit, at Commando Tool and Die Co., positive accuracy is a must in grinding the high-production tooling necessary for today's automobile and aircraft production race. Commando and many other shops in the area have found that Reid Surface Grinders provide the built-in accuracy that spells top performance year after year.

You, too, can have the precision, the better surface finishes, the dependability and convenience of operation that are engineered into every Reid Grinder. So why not plan now to replace the over-age surface grinders in your plant with new Reid Grinders.

Complete details are contained in Brochure 618-2 — request your copy today.

THE MACHINE TOOL SHOW CHICAGO, ILL.

Reid Brothers Company, Inc.

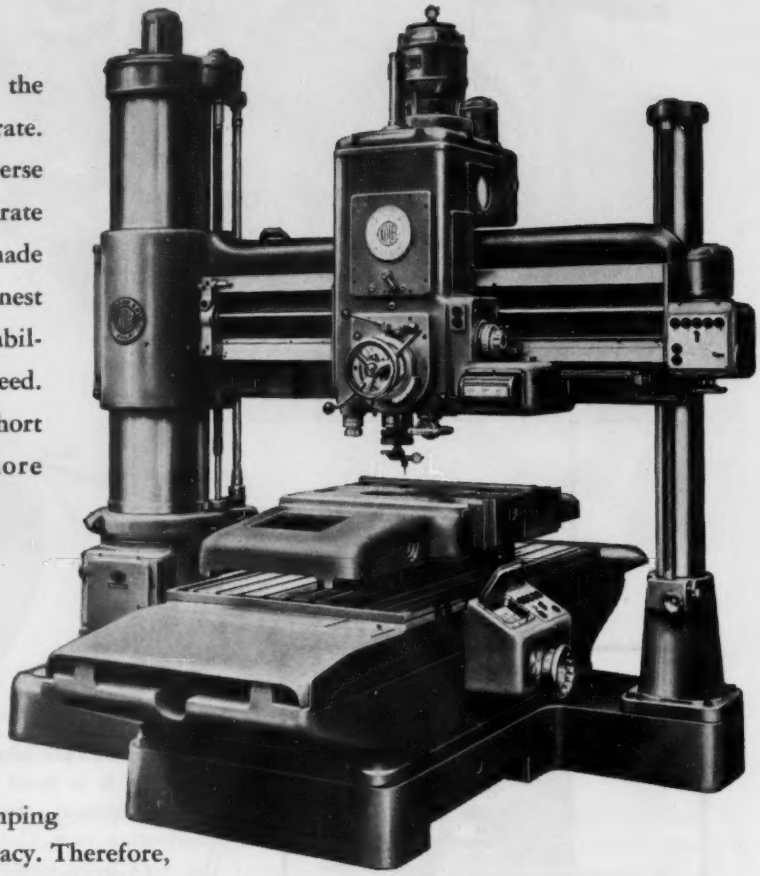
PRECISION REID SURFACE GRINDERS

BEVERLY, MASSACHUSETTS

WITH A KOLB OPTICAL JIG BORER

YOU CAN POSITION A WORKPIECE TO WITHIN .000125" IN A FEW SECONDS

Positioning a workpiece on the Kolb jig borer is fast and accurate. It's fast because of rapid traverse with adjustable stops—it's accurate because the optical system is made by Leitz, one of Germany's finest optical manufacturers. Repeatability of the coordinates is guaranteed. By eliminating costly jigs, short run jobs can be handled more profitably.



- Shock and distortion-free electro-hydraulic clamping does not impair accuracy. Therefore, reading accuracy equals positioning accuracy. Signal lights indicate if head and table are clamped or unclamped.
- Convenient pushbutton control—preselection of 18 feeds and 36 speeds.
- An excellent machine for drilling, boring, reaming, tapping and milling as well as precision measuring.
- Optical system has a magnification of 1:100—five inches on the focusing screen is equivalent to a movement of 0.05 inches along the coordinate.
- Working surface of table 69x39", clearance between columns 73", maximum distance between spindle and table 40".

Write for more information.

COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION. 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA contact COSA CORPORATION OF CANADA LTD., 40 Front Street West, Toronto

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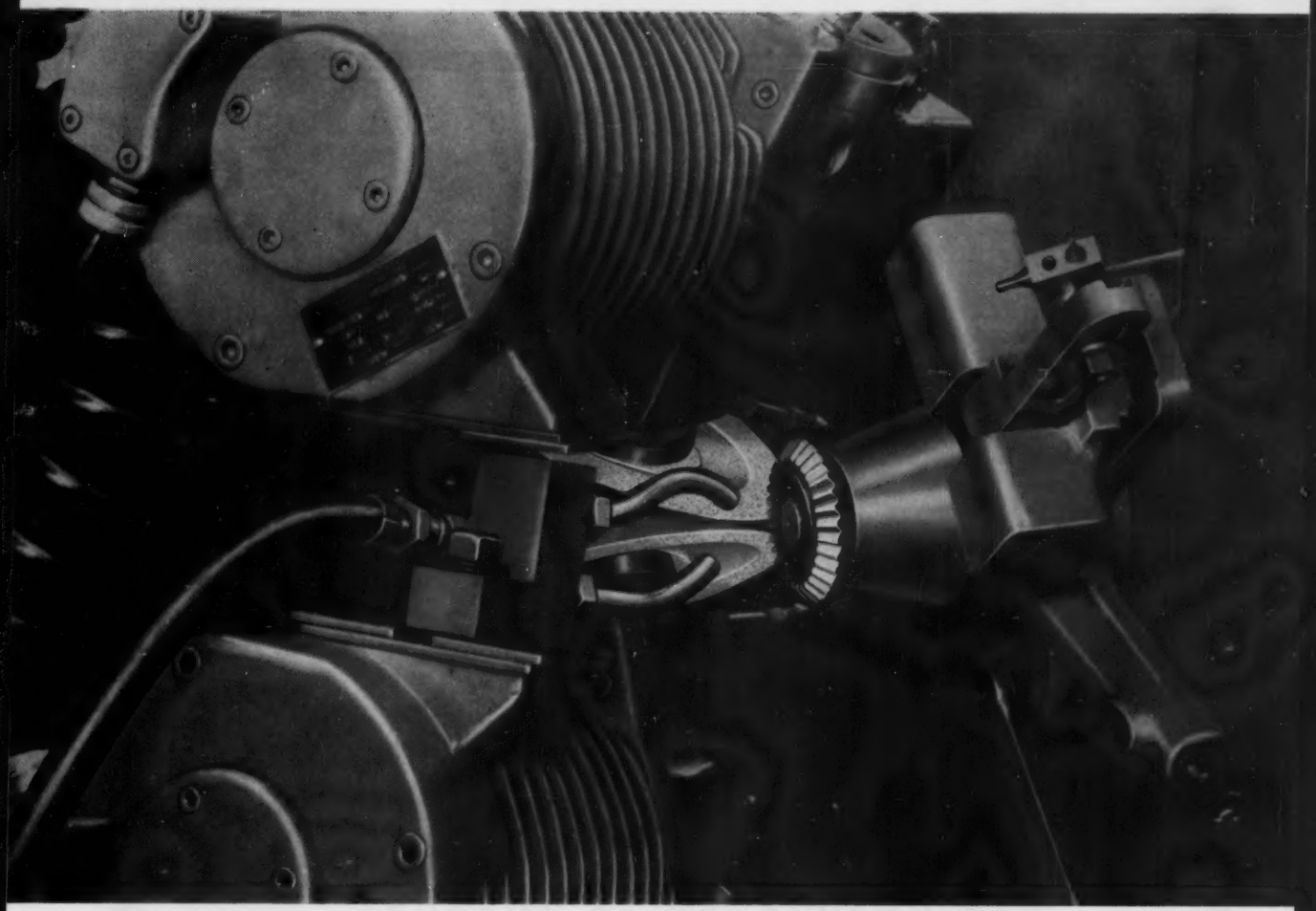


Now you can grind straight bevel Coniflex® gears

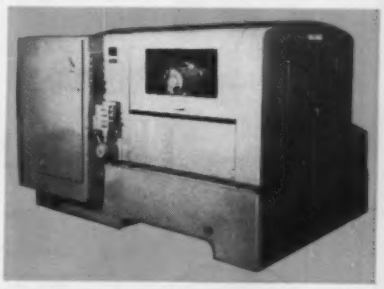
You can *now* use hardened and ground straight bevel gears for many angular drives requiring extreme precision and load carrying capacity.

The new Gleason No. 105 Straight Bevel Coniflex* Grinder generates gears with the highest accuracy of spacing and profile, with the tooth profile, fillet radius, and tooth bottom formed into one smooth blended shape by two grinding wheels.

And gears ground on the No. 105 Grinder after hardening *maintain their extreme precision* even under continuous load operation.

Wet-type grinding on this machine provides fast cycles and excellent finish. Set-up calculations are simple. The completely automatic cycle of the No. 105 Grinder not only assures uniformity of production but also provides great savings in time and production costs.

We will gladly send you more information about the No. 105 Straight Bevel Coniflex Grinder upon request.



The No. 105 Grinder accommodates straight bevel Coniflex gears up to 8½" pitch diameter, 3DP with ratios up to 6:1, cone distances up to 4¼". Gears 20DP and finer may be ground directly from the solid; coarser pitches are ground after semi-finish cutting and hardening.

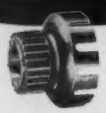
*Straight bevel gears with localized tooth bearing.

GLEASON WORKS

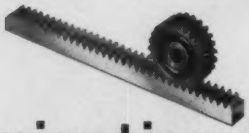
Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

ILLINOIS GEARS



The will to serve...



The determination to please...

The knowledge to execute...

The pride of accomplishment...

The guarantee to satisfy...

Look for this mark ILLG ... the symbol on finer gears

ILLINOIS GEARS Reg. U.S. Pat. Off.

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

2108 NORTH NATCHEZ AVENUE • CHICAGO 35, ILLINOIS

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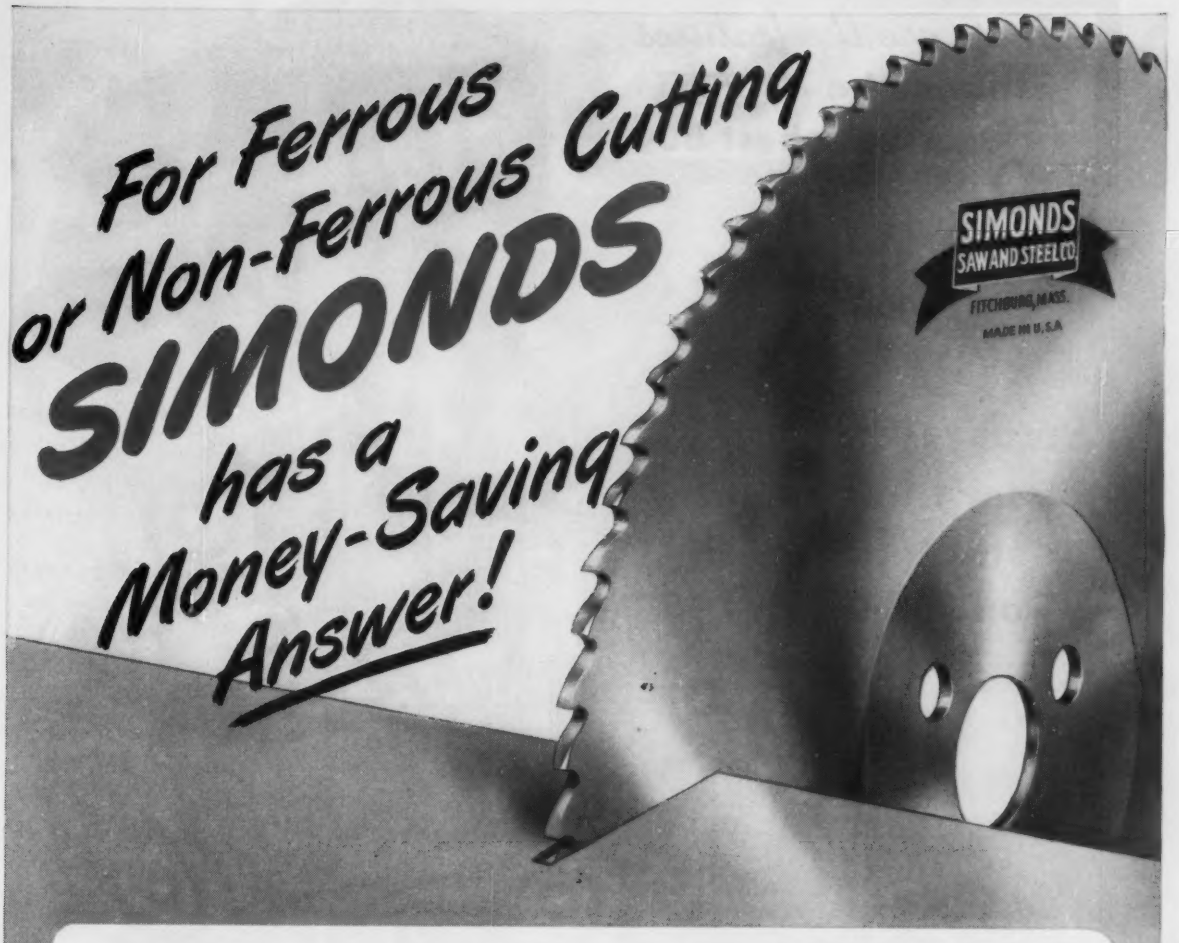


For Ferrous or Non-Ferrous Cutting SIMONDS has a Money-Saving Answer!

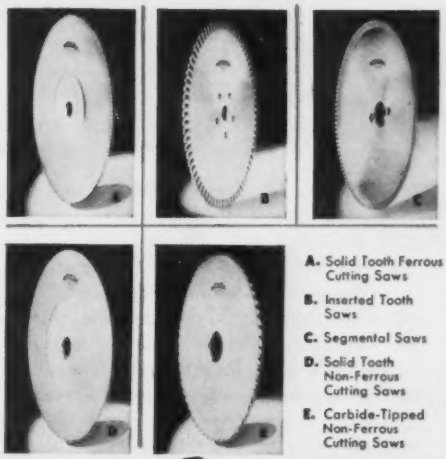
It pays to pick the best blade for every cutting job. You get faster cutting, longer blade life and maximum saw performance, with fewer shutdowns for resharpening or replacement. Whether you're working with ferrous or non-ferrous metals, Simonds is one source that offers you a complete line of job-designed saws — the most wear-resistant, edge-holding saws for any type of cutting.

For non-ferrous cutting, Simonds offers you a choice of four basic types — Si-Maloy* Steel Saws, Semi-High Speed Steel Saws, High Speed Steel Saws, and Carbide-Tipped Saws — plus Inserted Tooth and Segmental design Saws.

For ferrous cutting, Simonds offers you a choice of three basic saw designs — Inserted Tooth, Segmental, or Solid Tooth . . . to provide a "best" blade for specific cutting applications.

For more information on which blade is *best* for your job, ask your local Simonds Industrial Supply Distributor who stocks them, or write for Simonds Circular Metal Cutting Saw Bulletins today.

*Steel Analysis Patented



A. Solid Tooth Ferrous Cutting Saws
B. Inserted Tooth Saws
C. Segmental Saws
D. Solid Tooth Non-Ferrous Cutting Saws
E. Carbide-Tipped Non-Ferrous Cutting Saws

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

For Fast Service from Complete Stocks

Call your SIMONDS Industrial Supply DISTRIBUTOR

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que.
Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

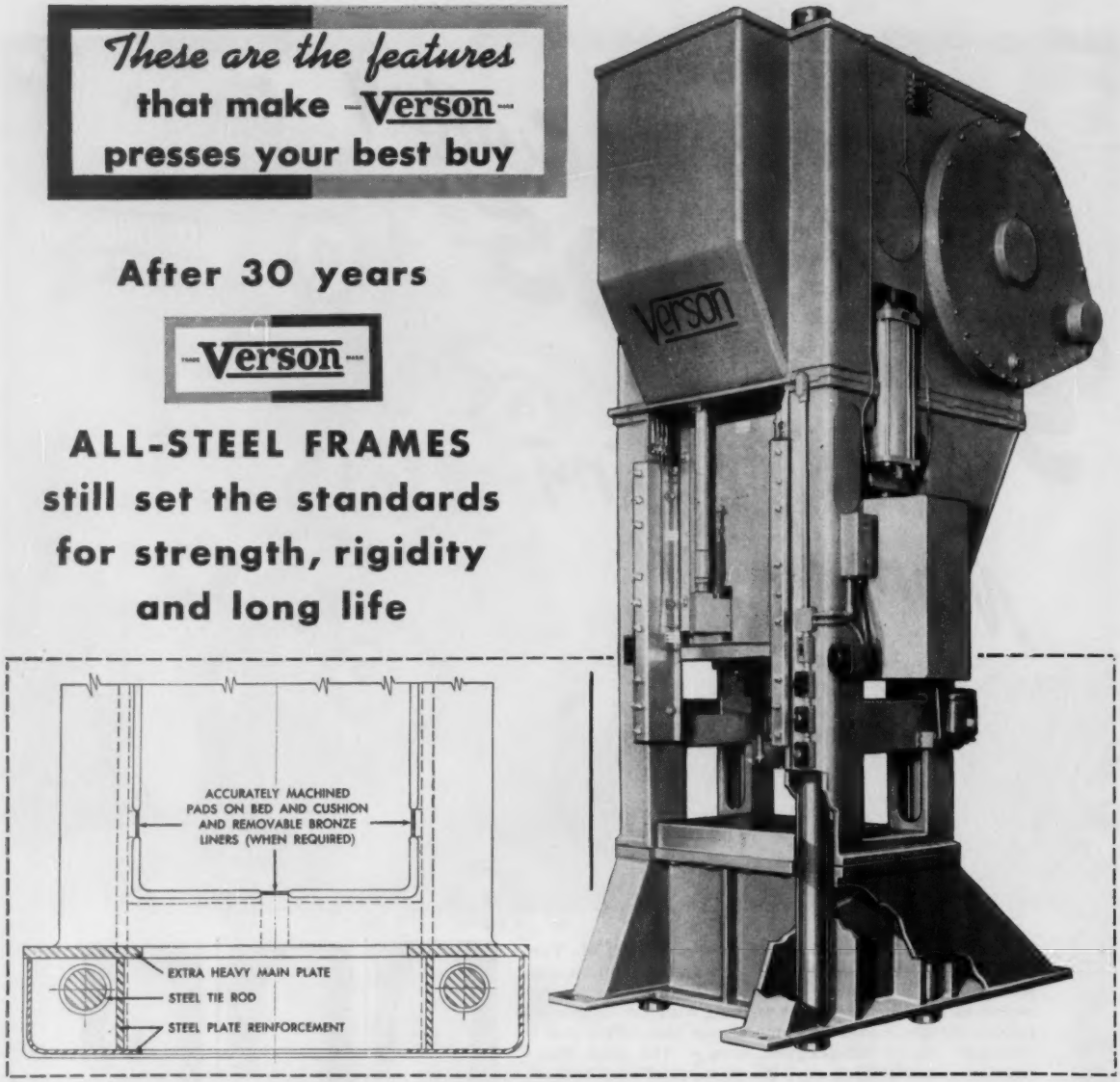
Circular Metal Cutting Saws

These are the features that make -Verson- presses your best buy

After 30 years

-Verson-

ALL-STEEL FRAMES still set the standards for strength, rigidity and long life


Verson
ACCURATELY MACHINED PADS ON BED AND CUSHION AND REMOVABLE BRONZE LINERS (WHEN REQUIRED)
EXTRA HEAVY MAIN PLATE
STEEL TIE ROD
STEEL PLATE REINFORCEMENT

For every action there is an equal and opposite reaction. The result in press design, is tool-damaging deflection.

Verson welded steel frame construction minimizes this problem because it utilizes high quality rolled steel plates . . . cut to shape, interlocked and welded into strong, rigid box sections. This construction capitalizes to the fullest rolled steel plate's advantages of greater uniformity and inherently greater strength. The extra strength and uniform quality of this steel plate assures the ability of the press to withstand high speed and repeated impact loads. Rigidity and resistance to deflection is also rated higher than with other construction materials.

Originated by Verson over 30 years ago, all steel welded frame construction gives you top performance—cleaner stampings—better drawn sections—and substantial savings in tool dollars when you use Verson Presses.

The Verson all steel frame is just one of many reasons for selecting Verson Presses. We'd like to tell you more . . . just call or write. For specific recommendations, send an outline of your requirements.

Ask us about our new customized installment and leasing programs.

A Verson Press for every job from 60 tons up.

-Verson-

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

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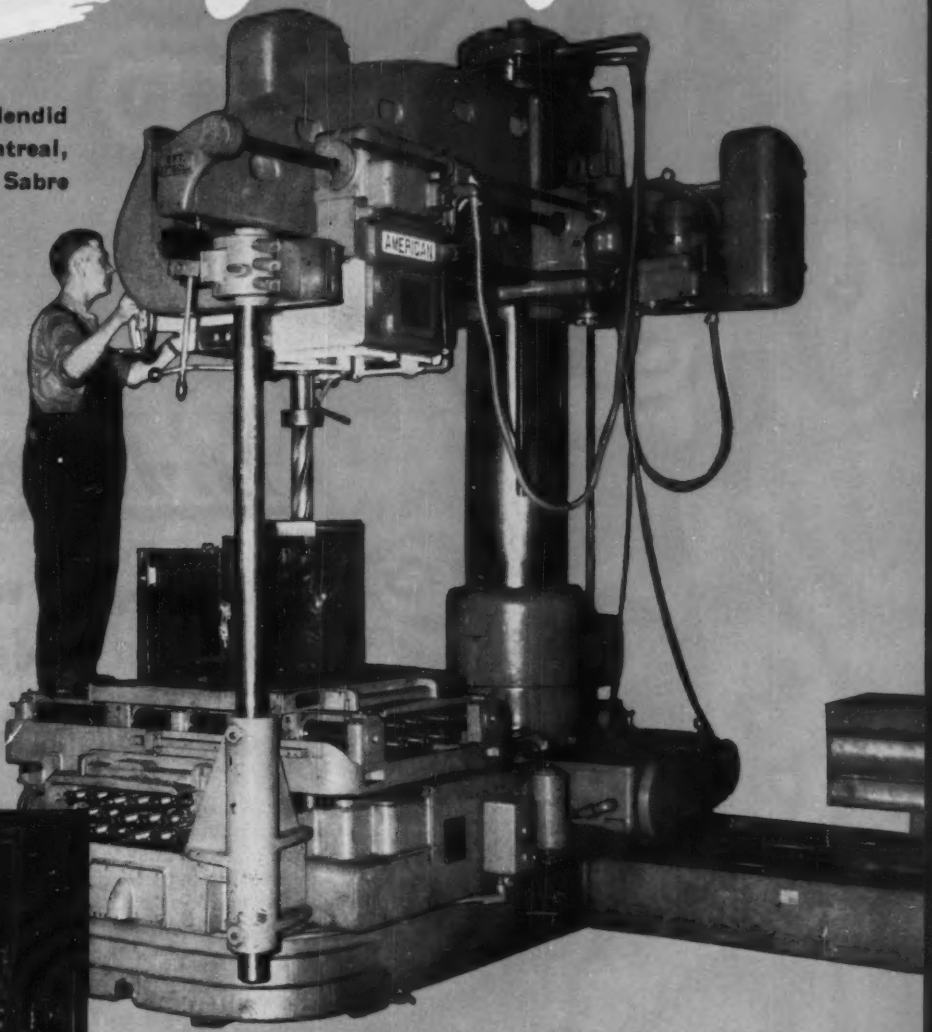
On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.



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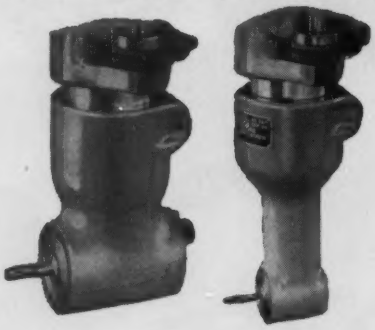

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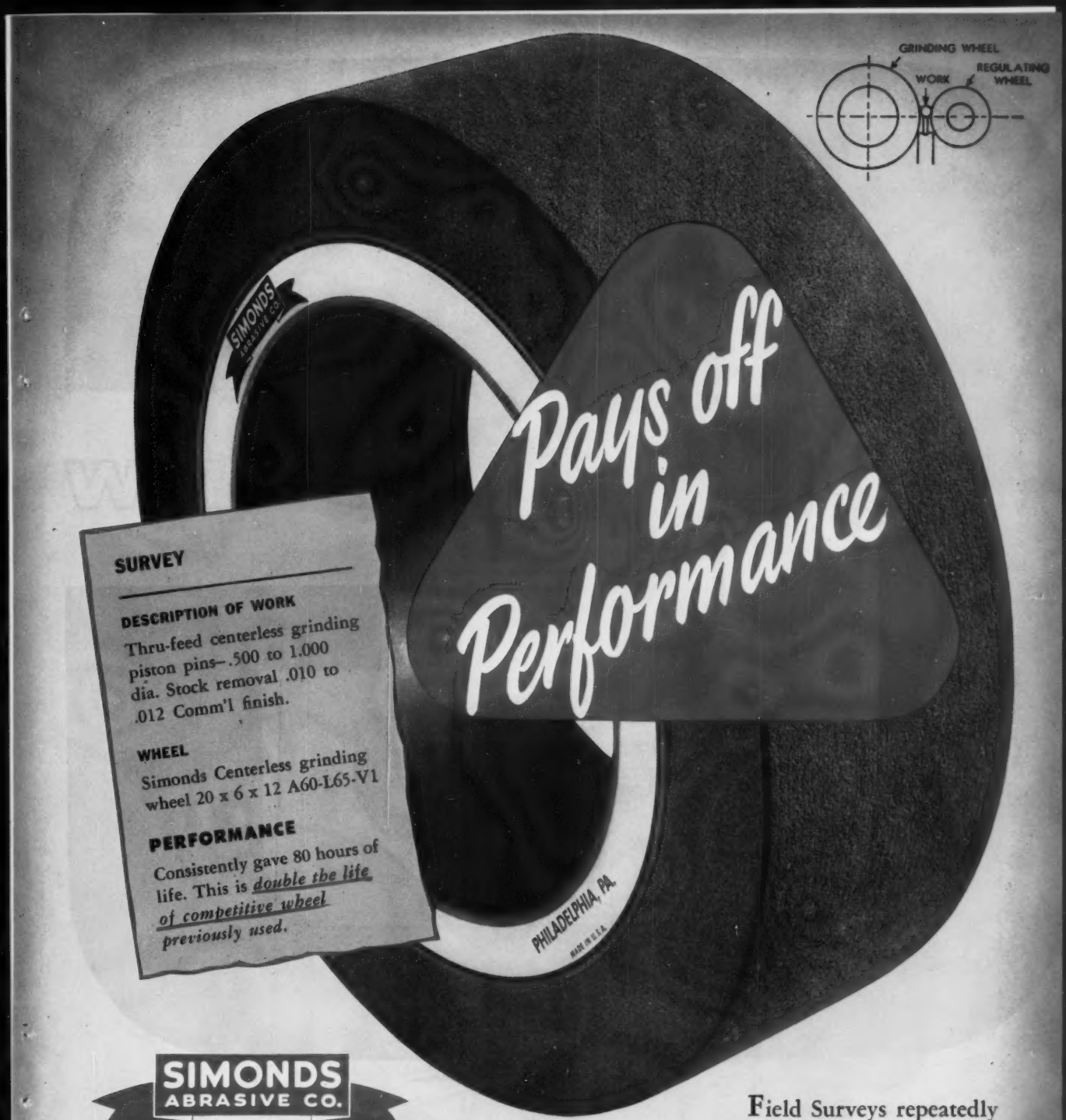

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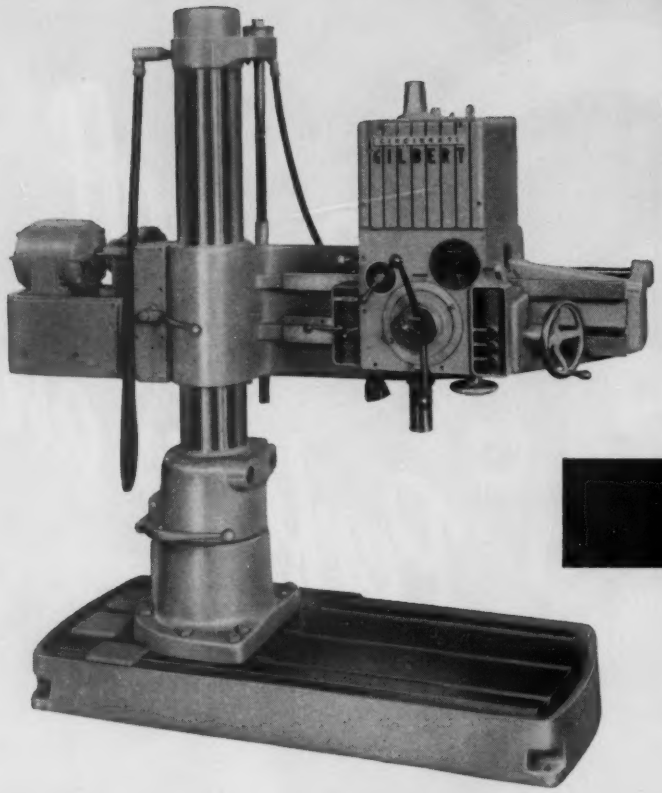

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By LORING F. OVERMAN

Senate Committee Reviews Leasing of Machine Tools

EACH new Congress finds it intriguing to try its hand at solving the machine tool problem. The big question is how to reconcile economy measures with the long-range goal of having the machine tool industry set for emergencies.

In its annual report, the Senate Small Business Committee asks: "To what extent will the defects in mobilization planning which plagued the machine tool industry in the first year and a half after Korea be avoided in a future crisis?" The report then answers: "On the specific actions taken to avoid recurrence of the 1950-51 chaos, your committee proposes to make a full study during this session of Congress. There are several recommendations:

"(a) A complete inventory of all Government-owned machine tools and other production equipment should be expedited. Furthermore, the tallies of the various agencies owning tools should be standardized in one list to be utilized by all branches of the Government, as needed." (The Office of Defense Mobilization, in a mid-April report to the Congressional Joint Defense Production Committee, indicated that considerable progress was being made toward such an inventory.)

"(b) No equipment owned by the Government should be leased for non-defense production, unless, and until, it can be clearly established that such action will, in fact, add to our national mobilization readiness. Exceptions should be allowed only on an individual basis after investigation.

"(c) As soon as possible, Government machines should be withdrawn from the production lines of private contractors. Such withdrawal will create a transition period during which contractors can replace Government equipment with their own.

"(d) In the meantime, an expert group, including representatives of the industry, should study rental fees charged for the use of these machines, with a view to bringing them more in line with private rental plans, and with the aim of removing the relative competitive position of firms holding Government machines and those without such machines." (The recent ODM report indicated that this study is progressing.)

"(e) The armed services, under the direction of the Department of Defense, should immediately draw up a preference list giving priority ratings to the various military items, so that a guide will be available the moment it is needed. This list should be updated frequently.

"(f) A study should be made to determine the impact of imports of foreign-made machine tools on the American industry.

"(g) The Office of Defense Mobilization should ascertain immediately whether its controls plans would expedite or hinder the rapid expansion of production in time of emergency."

ODM Recommendations

The Office of Defense Mobilization had much to say about machinery to the Congressional Joint Defense Production Committee. ODM Director Arthur S. Flemming commented that he is well pleased with the machine tool program started in 1951. Dr. Flemming's report said: "Approximately 87,000 machine tools, valued at $1,155,000,000, have been completed. Out of this total, all but 832, costing $10,900,000 were purchased by private industry. Of the 832 tools acquired by the Government, 152 valued at $1,991,000 have been resold, and seven tools valued at $163,000, have been transferred to other programs. As a result, only 673 tools, valued at $8,700,000, remain in Government storage."

In discussing rental rates, the report claimed: "During the last half year, the ODM has obtained and reviewed a study made by the American Machine Tool Distributors' Association on the rates of rental charged by commercial leasing concerns, reduced to simple interest per annum for comparative purposes. Commercial rates range from 7 to 33 1/3 per cent, with the average charge from 12 to 19 per cent, increasing with the length of term of lease. The customary rental charge for Government-owned equipment leased to private industrial establishments for defense and defense-supporting contracts is 1 per cent per month of the acquisition cost of the equipment. This charge, expressed in the same terms used in the industry study, equals a rate of 16.3 per cent for a typical five-year lease. Government rates are quite comparable to charges in competitive enterprise.

"The ODM has initiated a survey of all known elephant tools in the United States to determine whether there is a need for increasing the government-owned reserve of these large machines, and to determine the type and number needed, if any, to meet full mobilization requirements. The Business and Defense Services Administration and the Small Business Administration have been collecting and tabulating the relevant facts. Data covers seventy-one companies and 133 plants, and reveals a stock of 867 machines, one-fourth of which are less than ten years old, and one-half less than twenty years old."

Only days after submitting its report to the Joint Defense Production Committee, the ODM ruled that the military departments must buy needed machine tools, if available, from the stockpile acquired by the General Services Administration under pool orders placed during the Korean War.

This ruling means that orders to be placed under the so-called Vance plan must be offered first to the General Services Administration, instead of being turned over to manufacturers. Here, of course, is where the attempted economy runs into at least two obstacles. First, the original pool orders were placed with industry for the dual purpose of making them available to defense, and of keeping industry occupied at a reasonable pace. The second reason for concern over the new ruling is that the rapid pace of technology has already rendered some of the tools obsolete. There are indications that both industry and the services will put pressure on the new ruling, and that meanwhile there will be a further delay in placing orders under the Vance plan.

Vance Recommendations

In the ODM report to the Joint Defense Production Committee, reference is made to the appointment of an Advisory Committee on Components and Production Equipment, with Harold S. Vance as chairman. That committee, the report noted, recommended the procurement by the General Services Administration of $64,000,000 in machine tools to reduce a critical shortage in capacity to produce turbines and turbine gears. Dr. Flemming indicated his intention to approve the Vance report after confering with Congressional committees.

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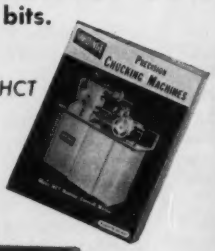

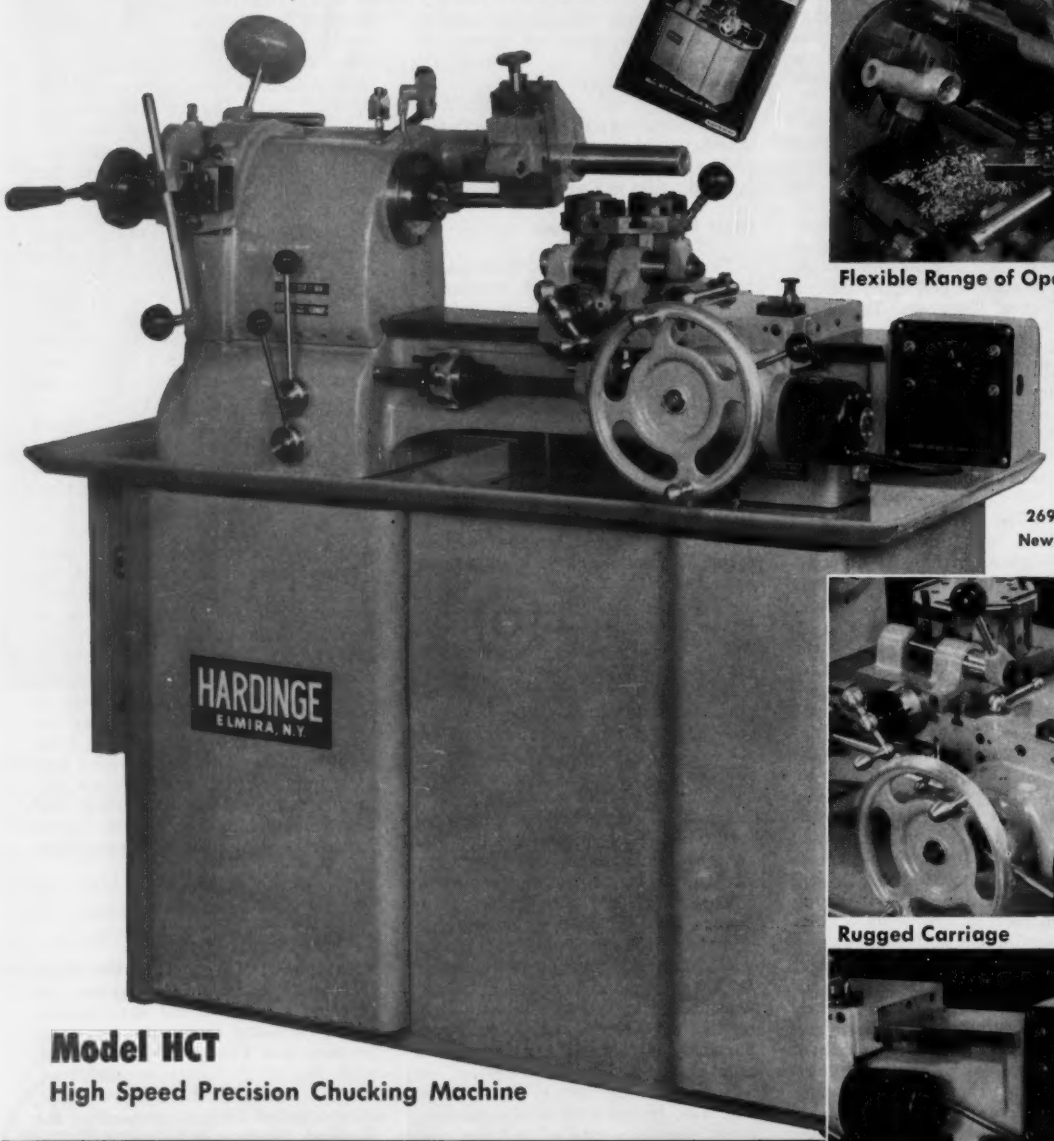

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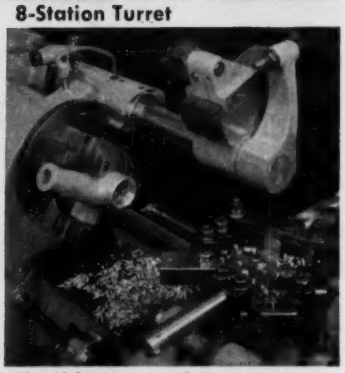
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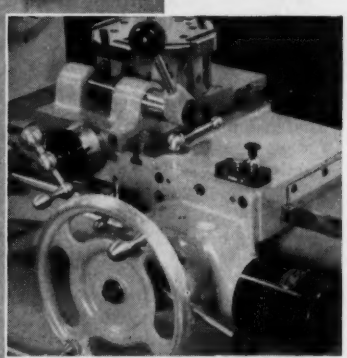
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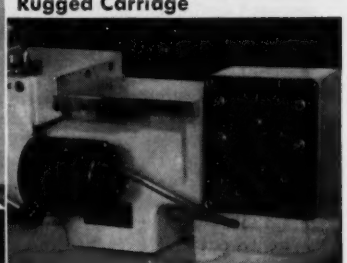
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MACHINERY
JUNE 1955

Why the Aircraft Industry Enjoys Peacetime Prosperity

FOR the first time in the history of the aircraft industry, it is operating on a truly planned peacetime basis. During previous interims between wars, the development and building of planes essential to the defense of our nation were carried out along meager lines. It was felt that in case of emergency there would be plenty of time to produce the aircraft necessary to defeat an enemy. Aircraft plants worked on reduced schedules and innovations in plane design were few.

Today the thinking on national defense is different. The Korean episode taught us a lesson. Never again can we afford to assume a complacent attitude with respect to the air power of a potential enemy. We must keep up with the developments of other countries and strive to surpass them both in airplane quality and quantity. The Air Force has admittedly become our first line of defense.

These are the reasons why the aircraft industry is enjoying unprecedented peacetime prosperity. Long-term planning is the order of the day—something the industry has always wanted. Programs are laid out several years ahead, bearing in mind the fact that it ordinarily takes eighteen months to get a fully designed plane in production—and five years to get a new plane conception through the stages of designing, testing, and setting up the facilities for manufacture.

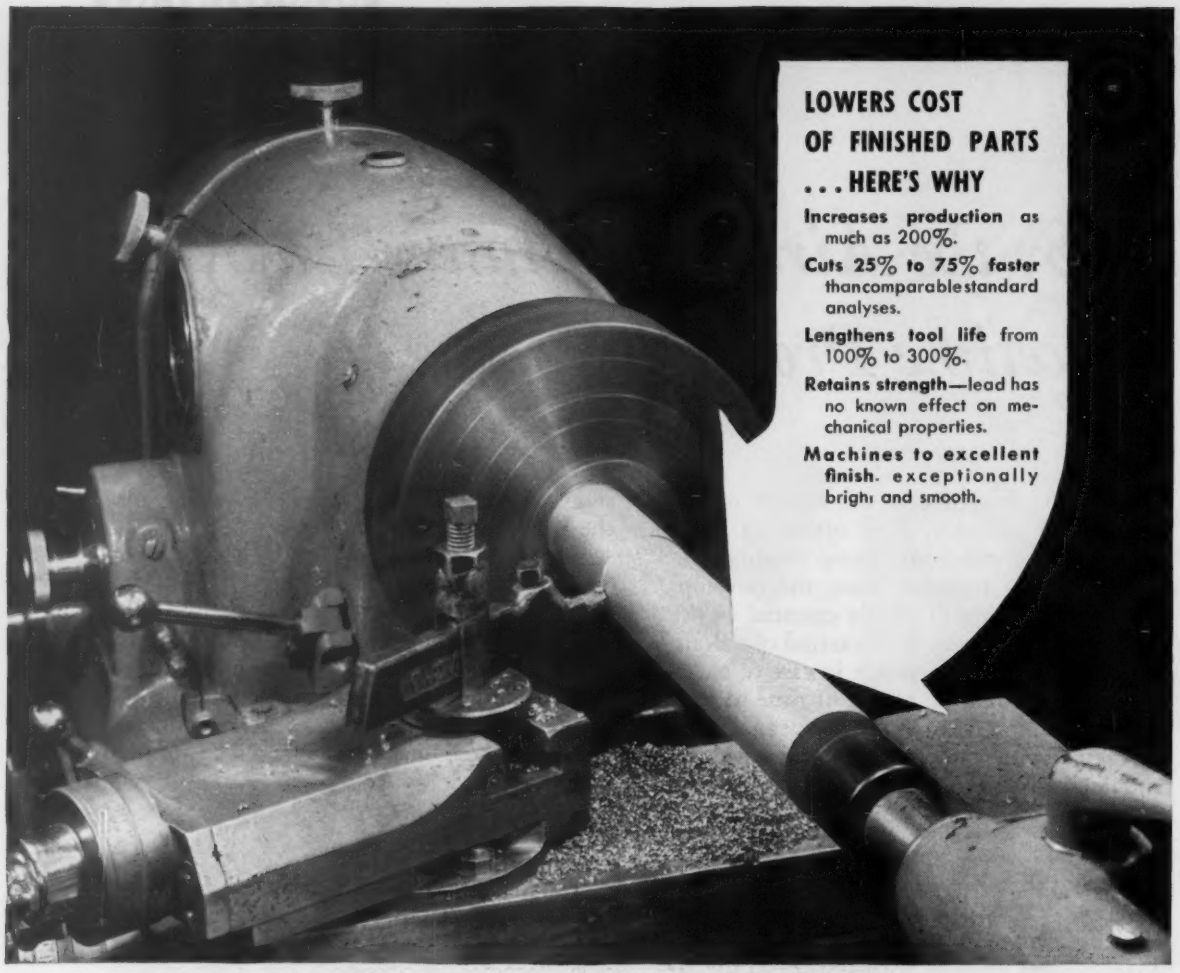
Under this new arrangement, the industry can function efficiently and economically. It costs less to gradually develop new production techniques and to keep manufacturing equipment up-to-date than to perform miracles along these lines in the event of a national emergency.

The daily newspapers keep us fully informed about the spectacular achievements of new types of aircraft as soon as the information becomes unclassified, but they rarely mention the important innovations in manufacturing processes. That is the province of a technical magazine and the reason for MACHINERY's Fifteenth Annual Aircraft Production Number.

The following editorial pages pay tribute to the production men of the aircraft industry by presenting technical information relating to some of their latest accomplishments. Standard methods and equipment are used whenever they can be utilized to maximum efficiency—otherwise special processes and machines are developed to meet the unique needs of the industry.

Charles O. Herb

EDITOR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The secret lies in the addition of a very small amount of lead (.15% to .35%) by a patented process. Finely dispersed, the lead acts as a lubricant between steel and cutting tool—giving greatly increased machinability without known effect on mechanical properties—the hardenability of New Rycut 50 compares with that of AISI 4150.

You can get quick shipment of New Rycut 50—annealed or heat treated in rounds of many sizes—from your nearby Ryerson plant. For worthwhile savings, try this remarkable alloy in your shop for production or maintenance applications.

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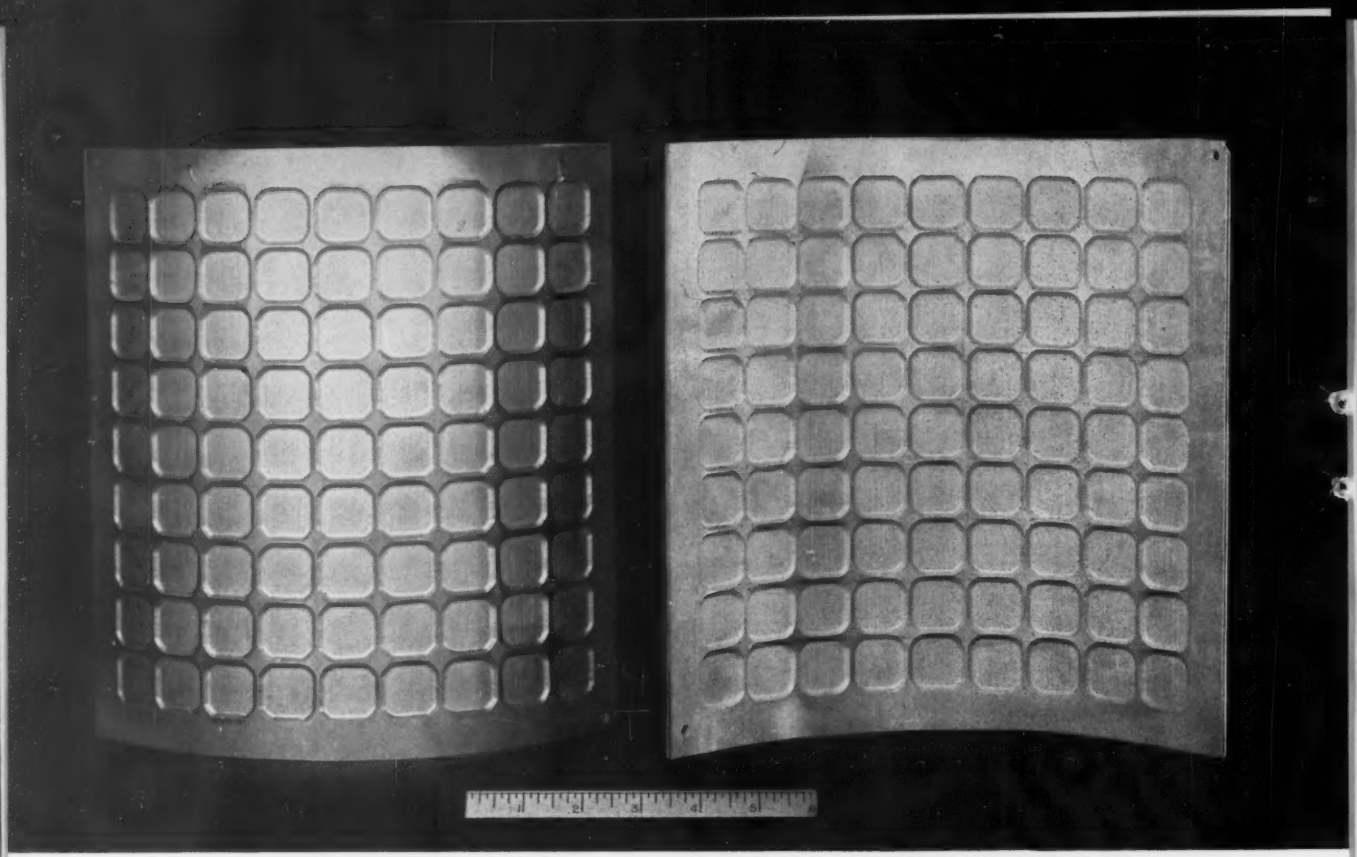
Billions of dollars worth of aircraft are on order today. Filling these orders will call for a continuation of the progressive attitude that has long characterized the production executives and engineers of the industry. MACHINERY'S Fifteenth Aircraft Production Number features some of their recent achievements, many of which are also applicable to other branches of industry.

Vol. 61, No. 10 MACHINERY June, 1955



Revolutionary application of the etching process which enables the convenient reduction of sections on metal parts after forming or forging without any change in important dimensions. Other manufacturing advantages are derived from employing this process

By MANUEL SANZ
North American Aviation, Inc.
Downey, Calif.

AN ever-present problem of the aircraft industries is to achieve maximum lightness of all plane components without sacrificing required strength. This problem was considerably aggravated with the development of supersonic aircraft. It has been solved to an important degree by thinning down large areas of structural members and by routing out metal from thick plates to provide long ribs.

This metal removal is generally effected by routing and milling operations on flat sheets and plates. In such operations, the radii of rounded corners are restricted to the size of the cutters employed and large cutters are customarily used to hold down machining time. Another disadvantage of these methods of "sculpturing" metal is that sheet metal that has been thinned down over large areas can seldom be formed without excessive warpage. It is generally impossible to sculpture by machining after the parts have been formed.

Two years ago, the Aerophysics Department in the Downey, Calif., plant of North American Aviation, Inc. started experiments on the removal of metal from aluminum sheets by chemical means and developed the process known as "Chem-Mill." The process is now being applied on a production basis by the concern. Licenses for the use of the process can be obtained from Turco Products, Inc., Los Angeles, Calif.

In chemical milling, the part to be etched is first masked with chemical-resistant paint on the areas where the original thickness of the sheet or plate is to be maintained, or where the minimum thickness is not desired. Then the entire part is immersed in an etching solution for the removal of metal from the unprotected surfaces. The length of immersion is accurately controlled, so as to obtain exact weights and proper geometrical reliefs in the work-pieces.

The etching solution, or etchant, is proportioned to give a metal removal of 0.001 inch in

"Chem-Mill" on a Production Basis at North American

depth per minute. Since metal is removed simultaneously over a large area and also from a number of parts immersed in the etching tanks at the same time, the process affords important economies. Etching is being carried out to depths as great as 2 inches on aluminum, titanium, nickel, and other alloys, as well as on steel and brass. Chem-milled surfaces are smooth to a high degree and do not require subsequent polishing. The operation is being applied to formed parts after they come from the forming operation and there is no effect on the accuracy of their contours.

The heading illustration shows two mating parts having a large number of square pockets that result in a waffle design. The concave waffle is placed on the convex waffle to obtain a "sandwich" of minimum weight and maximum strength. The Chem-Mill process is also applied to such parts as extrusions that are heavier than necessary, for the simultaneous removal of metal from some or from all surfaces.

The first step in Chem-milling is to thoroughly clean the work-pieces in the equipment seen in Fig. 1. The parts are immersed successively in a solvent degreaser tank; an alkaline cleaner tank that is held at a temperature of 180 degrees F.; a cold-water rinse tank; a chromic-acid tank; and a hot-water rinse tank.

Then the parts to be masked are transferred to the department shown in Fig. 2 and generally covered completely with adhesive tape. Next a template is placed over the work-piece, as seen in this illustration, and pencil lines are drawn around all openings of the template. A sharp instrument is next moved all around the pencilled lines to cut through the tape, and subsequently (after paint spraying) the tape is stripped from the areas that are not to be etched. This masking

Fig. 1. Aircraft parts being lowered into an electric drying oven after having been Chem-milled for the removal of excess metal without the performance of machining operations. The equipment here seen is also used for washing and drying sheets and plates prior to Chem-milling.

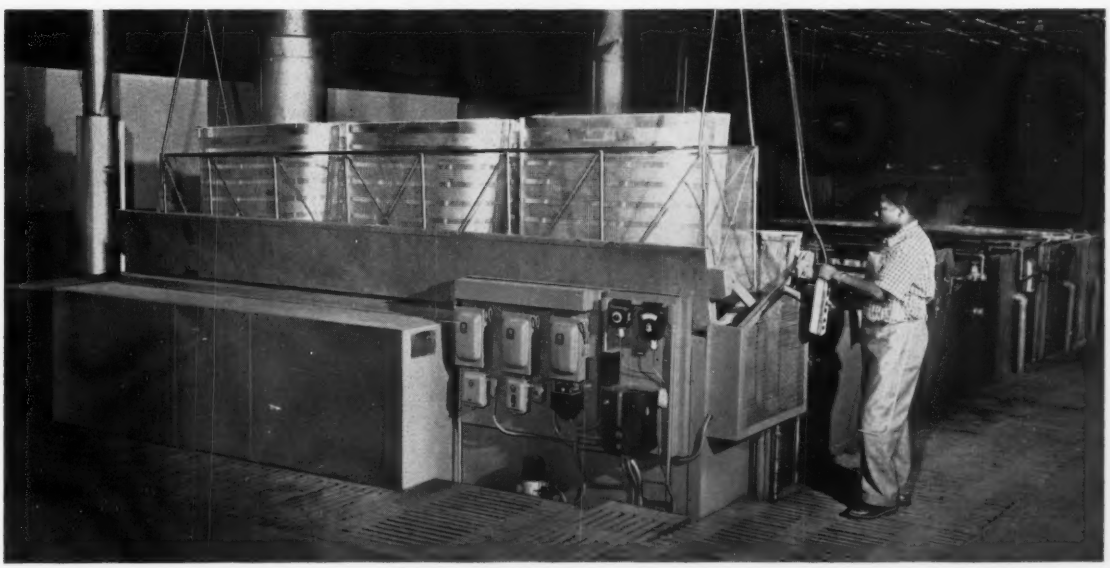


Fig. 2. View of the department in which adhesive tape is applied to work-pieces, marked by pencil, and stripped from areas that are not to be exposed to etching solution in Chem-Mill process.

Fig. 3. Checking the dimensions of a template which constitutes the only tooling required for removal of metal from work-pieces by the Chem-Mill process.

Fig. 4. Spraying rubber-compound type paint over complete sheets of aluminum to provide a protective coating against the etching acid, after which adhesive and paint are removed from sections that are to be attacked by the etching solution.

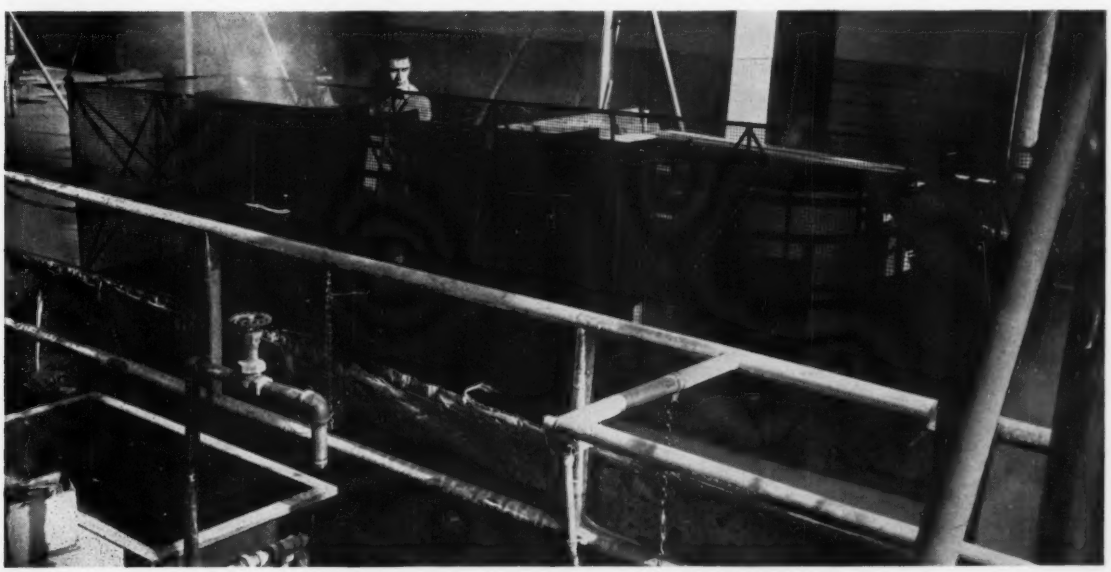
Fig. 5. Parts for the F-100 Super Sabre ready for the Chem-Mill tank with all surfaces not to be etched protected by a heavy rubber-compound paint.

procedure is being improved. An inspector is seen in Fig. 3 checking the dimensions of a typical template. From this illustration, the small radii to which rounded corners can be made by the process are readily apparent. Incidentally, templates are the only tooling required in the Chem-Mill process.

From the masking department, the parts are transferred to the painting area illustrated in Fig. 4, where the entire surfaces of the parts are spray-painted as they are carried by a conveyor past several painting stations. The paint is a material that offers high resistance to etching acids. From the painting booths, the parts are carried through a drying oven, after which the adhesive tape, now with paint on it, is stripped off to expose all areas that are to be etched. Typical parts painted, dried, and stripped, ready for etching are seen in Fig. 5.

Etching is performed outdoors in the equip-

Fig. 6. Lowering several formed aircraft sheets into the etching tank employed in the Chem-Mill process for removing unwanted material in various areas of work-pieces.



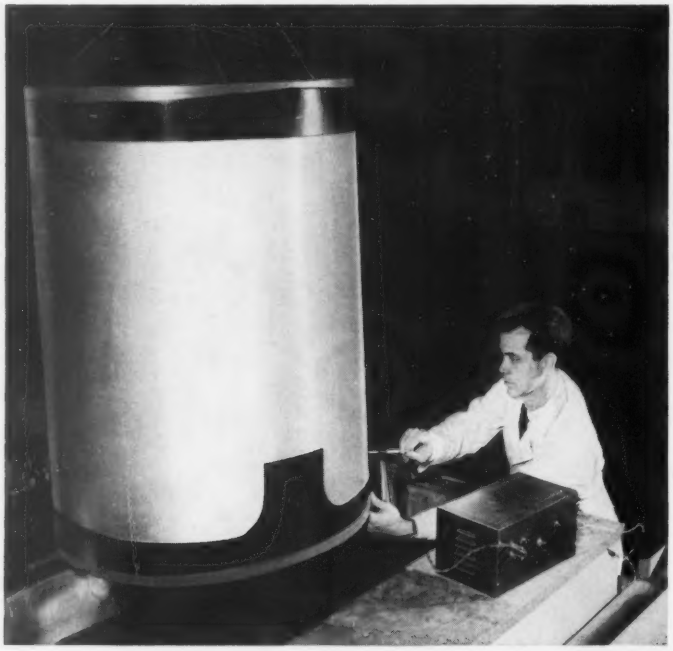


Fig. 7. Electrical instrument by means of which the thickness of sheet metal can be determined at any point on a part after etching.

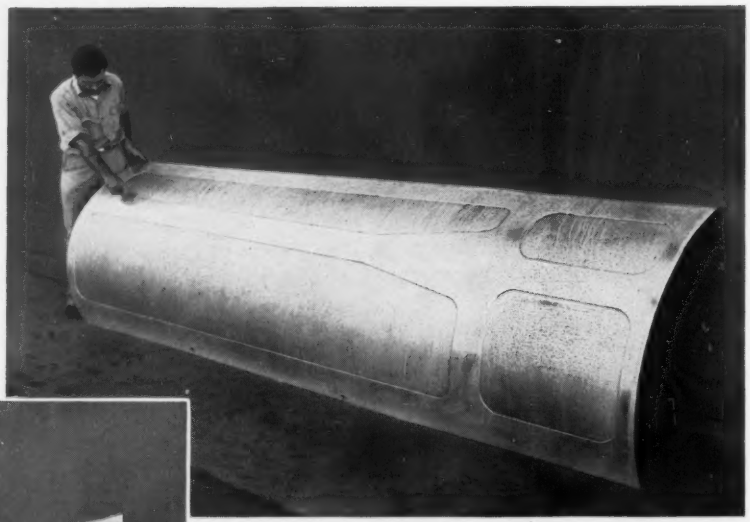


Fig. 8. (Above) Aluminum-alloy skin for an airframe about 10 feet in length on which metal has been removed from four large areas by the Chem-Mill process.

Fig. 9. (Left) Panel marked to show several thicknesses that can be obtained on a typical sheet-metal part by stripping the protective paint coating from various areas at different periods in the operation.

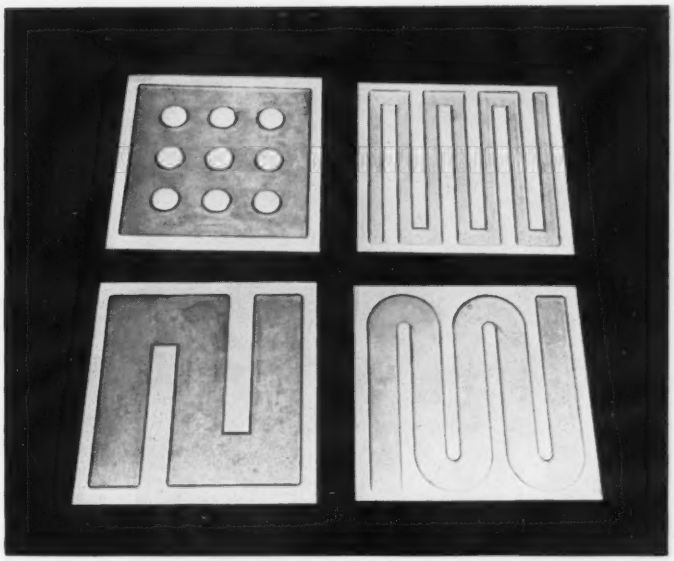


Fig. 10. (Top) Four examples of fairly complex shapes with sharp corners that illustrate some of the possibilities of Chem-milling.

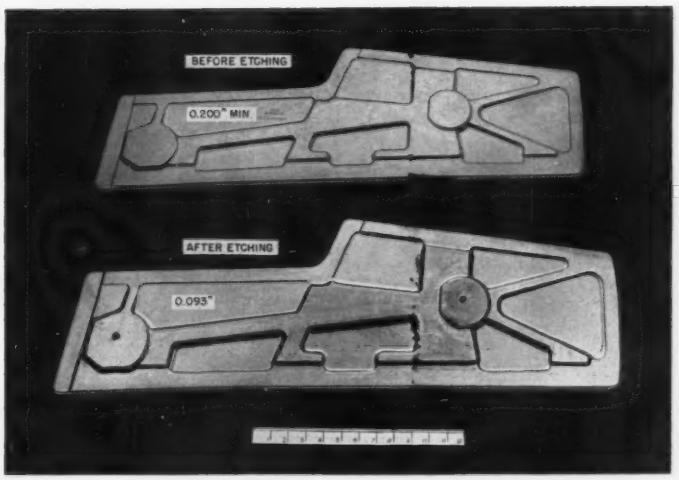
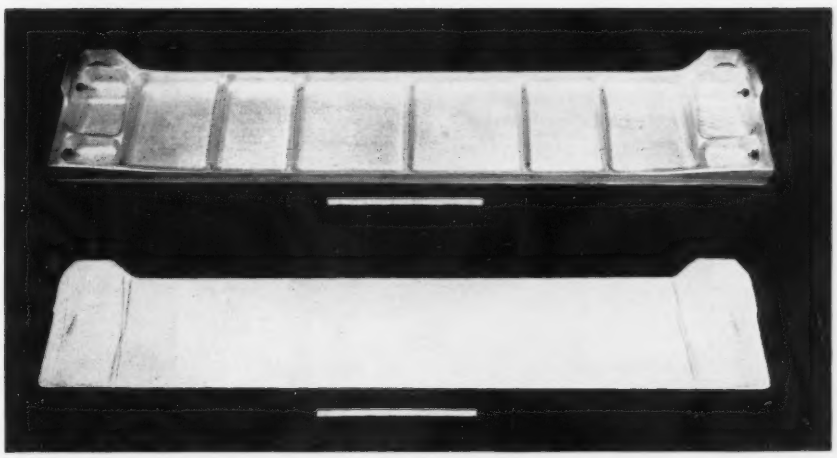


Fig. 11. (Center) Large aluminum-alloy forging before and after a Chem-Mill operation which was performed to obtain light weight through a reduction in web thickness.

Fig. 12. (Bottom) Two views of another large forging which was reduced in weight by Chem-milling metal from the entire surface.



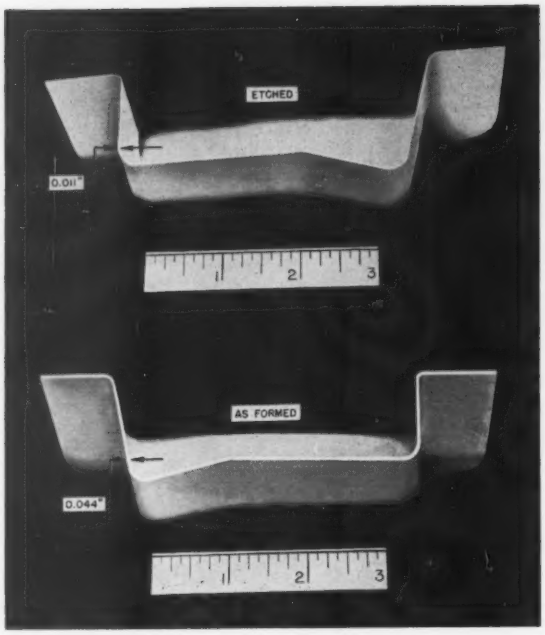


Fig. 13. Deep-drawn stamping which originally had a thickness of 0.044 inch all over as formed and a thickness of only 0.011 inch on all surfaces after etching.

The original thickness of the sheet was 0.125 inch. Chemical milling reduced four large areas to a thickness of 0.040 inch.

In Fig. 9 is a panel that had an original thickness of 1/8 inch. By etching, metal reductions were made to three different thicknesses in several areas, as indicated. This variation in etching was accomplished by removing the protective tape from the thicker areas after some etching had been performed on the areas that were finally reduced to 0.032 inch. This practice is called step etching. Chem-milling can be applied to parts of fairly complex design and having comparatively sharp corners as is apparent from Fig. 10. It will also be seen that bosses can be left on parts for the convenient attachment of various components. At the top in Fig. 11 is seen a forging

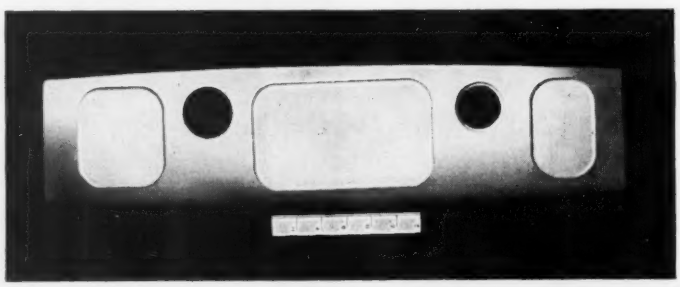


Fig. 14. Wing center-rib section approximately 4 feet in length in which two holes were completely etched through the material and three other areas were etched to a specified thickness.

ment illustrated in Fig. 6, although the plan is to house this area within coming months. The length of time parts remain in the tank depends, of course, upon the depth of metal to be removed. For example, if metal is to be removed to a depth of 0.125 inch, the work would be immersed for two hours, five minutes. A cold rinse immediately follows etching, after which the painted adhesive is stripped from the work by hand and the Chem-milled part is rinsed with water. All parts are then returned to the equipment shown in Fig. 1 for thorough cleaning and drying. In Fig. 7 is illustrated an electrical instrument that is used for checking the thickness of etched surfaces.

A large aluminum-alloy airframe skin which illustrates the possibilities of chemical milling after a part has been formed, is shown in Fig. 8.

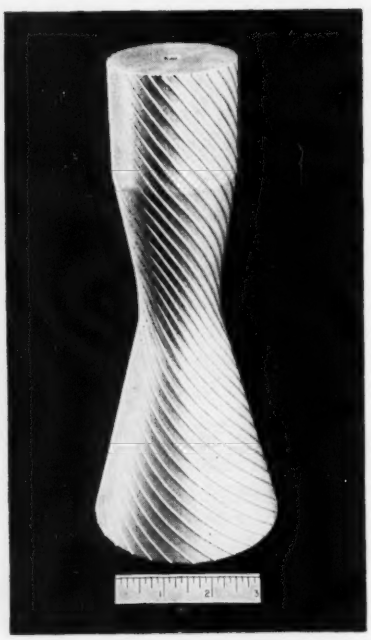


Fig. 15. Rocket engine block of aluminum alloy on which coolant channels have been produced to helical outlines without any machining operations.

having a web with a minimum thickness of 0.200 inch as it comes from the forging hammer. By the Chem-Mill process, the thickness of the web was reduced to 0.093 inch as indicated by the bottom view of the same forging. Another large aluminum-alloy forging that was considerably reduced in weight by etching all surfaces is shown by the two illustrations in Fig. 12. This forging is approximately 6 feet in length. In Fig. 13 is shown a part that was deep-drawn from stock 0.044 inch in thickness as illustrated by the bottom view. All surfaces were etched to a thickness of 0.011 inch as indicated by the top view. In the Chem-Mill processing of such parts, no masking of the work is required, since metal is removed from all surfaces. Holes can be etched completely through a part as will be apparent from the view of a wing center-section rib presented in Fig. 14.

A novel example of the possibilities of the new process is presented by the rocket engine block illustrated in Fig. 15. The helical coolant grooves around the asymmetrical part were produced without any machining operations. Tapered parts having, for example, the shape of a pool cue can be produced by gradually withdrawing an unmasked rod from the etching tank. Steel blocks used as dies in forging and extrusion operations have been Chem-milled readily to intricate designs.

Sheet thicknesses in Chem-Mill operations can be held to specified dimensions within plus or minus 0.002 inch. Flexural fatigue tests have indicated that Chem-milled sections possess the same strength in pounds per square inch as the parent metal. The etching solution has a strong alkalinity. Certain agents are added to produce smooth surfaces and uniform etching.

Chem-Mill has opened a wide range of possibilities not only in the design of aircraft components, but many other products as well. It provides a wide scope for designing engineers, since it does not confine them to age-old conceptions of machining practicability.

Rubber-Pad Forming on Huge Hydraulic Press

Wing stiffeners, inner skins, and similar components for Boeing's B-52 Strato-Fortress are now being produced on a 7000-ton Bliss Hydro-Dynamic press recently installed at Boeing's Wichita, Kans., plant. The press, seen in the accompanying illustration, is essentially a single-action press of open-rod "moving-down" construction, and weighs about 1,000,000 pounds. Despite this mass, however, the slide can be advanced and returned at a rate of 300 inches per minute or inched slowly.

According to Boeing engineers, the tremendous pressures they obtain with this hydraulic press make it possible to heat-treat aluminum superalloy parts prior to forming. Parts produced this way have high mechanical properties.

The rubber-pad technique used by Boeing with this press is desirable, particularly in short-run production, since it just about halves the cost of tooling for long-length parts. The size of the rubber pad, 4 by 10 feet, makes it possible to load the die slide with a variety of work. The two die slides, both power-operated, are located on opposite ends of the press. While one slide is in the press, a separate crew loads the other.

Rubber-pad technique is used on this huge 7000-ton hydraulic press to produce parts for Boeing's B-52 Strato-Fortress

Forging Delta Wing Spars

Supremacy in the air demands that frame and engine designs make maximum use of large forgings that combine high strength and light weight. With the long-heralded United States Air Force heavy press program reaching fruition this year, these forgings already are exerting tremendous impact on performance and on production

By EDGAR ALTHOLZ
Associate Editor

THE biggest light-alloy member ever press-forged in a single die is a delta wing spar for the Convair F-102 supersonic all-weather interceptor. This spar, Fig. 1, represents the initial production of the new Loewy 35,000-ton closed-die forging press at the North Grafton, Mass., plant of the United States Air Force, operated by the Wyman-Gordon Co. Made of aluminum, the spar measures 12 feet in length and tapers from a maximum width of 18 inches. A series of integral cross-ribs serve as stiffeners.

Four such spars in each F-102 replace 272 parts and 3200 rivets, and eliminate hundreds of man-hours of fabrication. What is more, the four forged members combined weigh 100 pounds less than their fabricated equivalents. This advantage was attained largely by being able to forge the spar to thinner cross-section. (Some areas of the spar are only 3/16 inch thick.) In combination with other forged replacements that are being made in the interceptor, the weight-saving potential—so vital to air superiority—is considerable.

Important structural parts for other military airplanes are now also forged on the 35,000-ton press. Among these airplanes are the Republic F-105, the North American F-100, and the Boeing KC-135. Parts are being press-forged to precision dimensions; often, the only machining required is the finishing of attach surfaces.

First Press Operating in U.S.A.F. Program

The press, seen in the heading illustration, is a Gargantuan creation, and embodies several important new design principles. The first of the four hydraulic forging presses completed under the U.S.A.F. heavy-press program, it was

Delta-Wing Convair F-102A

on a 35,000-Ton Press

placed in service in March of this year. It is, at the time of writing, the largest forging press operating anywhere in the world. A 50,000-ton press, also a Loewy, is now being installed in an adjacent area in the North Grafton plant, and will be placed in operation this summer.

The press has a dead weight of 7180 tons, with the moving parts weighing 4050 tons. It stands 45 feet above the operating floor and extends 62 feet below. Unique "upside down" arrangement places its eight main cylinders and hydraulic piping in the stationary substructure, and permits the entire upper entablature to stroke as a unit. Also, it is claimed, the arrangement makes the more vital parts of the press less vulnerable to an air attack. Substituted for the round, threaded-end tie-rods of conventional presses are four 315-ton columns, each made up of three rectangular "dog biscuit" laminations over 101 feet long. Other details of the press and its auxiliary and "back-up" equipment will be considered in describing the sequence of operations performed by Wyman-Gordon in forging the delta wing spar.

Inspecting and Pre-Working the Ingot

Spar material arrives in the plant in the form of billets of 7075-S aluminum alloy. In a 100 per cent acceptance inspection, a small specimen

Fig. 1. The first forging produced on the 35,000-ton press was this 12-foot long delta wing spar.

cut from the end of the billet is given a chemical analysis and checked for forgeability and freedom from porosity. The chemical analysis is made by spectroscopy on the equipment illustrated in Fig. 2. An electric source unit generates a spark between the specimen and a carbon electrode. As the metal becomes electrically excited, it emits light which is directed to a diffraction grating and separated into its various wave lengths and recorded on a strip of film in the spectrograph. By comparing the spectrum lines in the film with master spectra, all elements present in the specimen are readily identified; and by measuring the blackness of the lines, the quantity of each element can be determined.

Spars are Forged in Three Steps

Following preparatory operations on smaller presses, the spar is ready for the 35,000-ton

Fig. 2. A small specimen taken from the end of each billet received undergoes a chemical analysis on the spectrographic equipment illustrated.

press. Forging involves three separate steps: preblocking, blocking, and finishing. Upper and lower dies for each impression measure 142 by 42 by 20 inches and 142 by 42 by 18 inches, respectively. For some time prior to their use, they are soaked in die-heating furnaces at a temperature of 650 degrees F.

To install the dies, the press table is run out hydraulically over massive flat ways, seen in the foreground of the heading illustration. The die sets, each weighing approximately 33 tons, are transferred to and from the table by a 100-ton crane. In Fig. 3, one of the die sets is shown after it has been lowered onto the table. When the lower member has been clamped, the table is run in, the upper entablature lowered, and the upper member clamped. During non-operating intervals, die members in the press are several inches apart, and maintained at heat by a perforated gas-pipe rig which is temporarily laid between them.

Prior to preblocking, the spar is heated to 790 degrees F. for three hours or more in a furnace next to the press. Then, the work is conveyed by lift-truck to the press and slid onto the lower die member. As the upper entablature descends on the down stroke, its entire weight of 4050 tons is brought to bear on the dies. The 35,000-ton squeeze which closes the dies is produced by the build-up of the fluid power in the eight main cylinders to 450 atmospheres (6750 pounds per square inch). Four compensating cylinders equalize the load imposed on the dies, which otherwise would vary because of differences in mass within the die cavities.

On the up stroke, the upper entablature is raised by four other pull-back cylinders. (Two of these appear in Fig. 4, which shows the removal of the preblocked spar.) Upon removal of the work, it is allowed to cool, and the dies are blown out with air and lubricated by a blast of a kerosene and graphite mixture. Meanwhile, a second lift-truck conveys a new spar to be preblocked from the furnace to the press.

When cooled, the preblocked spar is pickled to remove the graphite picked up from the dies, so that it can be inspected more readily. Flash is then trimmed off on a band saw, and imperfections are ground out. For the subsequent blocking and finishing operations, an identical procedure is followed. To facilitate the handling of work into and out of the press, a manipulator is now being built. Removing the flash will be speeded by a Clearing 3000-ton trimming press now being installed in the area between the two new press giants.

Immersion Test Discloses Flaws

Following finish-forging, the spar undergoes a six-and-one-half-hour heat-treating cycle to improve its physical properties. The work passes through a three-zone furnace, reaching a temperature of 880 degrees F. in its three-hour period in the last zone, and then automatically is quenched in water.

Fig. 3. Installing one of the die sets for the delta wing spar. Less than twenty-five minutes are required to completely replace one die set with another.

Fig. 4. Removing a spar from the press following preblocking. After pickling and trimming, the spar will be reheated for the blocking operation.

Careful hand straightening on small hydraulic presses removes distortions developed in the heat-treatment. When the operation is completed, the spar is straight well within the total permissible end-to-end variation of 0.06 inch. The final phase of heat-treating involves a twenty-four-hour aging at 240 degrees F. in order to stabilize the spar.

Internal flaws, or discontinuities, in the spars are detected in the 100 per cent ultrasonic immersion inspection illustrated in Fig. 5. Here, a transmitter delivers high-frequency electrical impulses to a quartz crystal that is used to scan the immersed spar. The crystal transforms the electrical impulses into very rapid vibrations (ultrasonic waves) that travel through the water and the forging under test. The waves travel without interruption through homogeneous material, but are reflected by any mechanical discontinuities. Reflected waves return as amplified electrical impulses and appear on a cathode-ray tube as vertical indications along a basically straight line.

Later, the spar is given a dimensional check, then tested for hardness, having to meet a specification of 159 Brinell, or more. As a final step, prior to shipment, one delta wing spar from every run (125 to 150 work-pieces) is removed and subjected to a series of destructive tests in the plant laboratory.

Accumulator Station Supplies Fluid "Muscles"

Complementing the two new presses at the facility in North Grafton is an adjacent hydropneumatic accumulator station, Fig. 6, which supplies the fluid operating power. There are eleven accumulator bottles, seven Worthington pumps, and two air compressors, as well as prefill tanks, a gravity tank, and intensifier units.

When the press does not demand fluid (water and a rust-preventing additive), the excess fluid collects in the gravity tank. There, cooling coils maintain a pre-set temperature, the fluid is strained of foreign matter, and make-up water is added. At the start of a forging cycle, fluid from the prefill tanks, at a pressure of 60 pounds

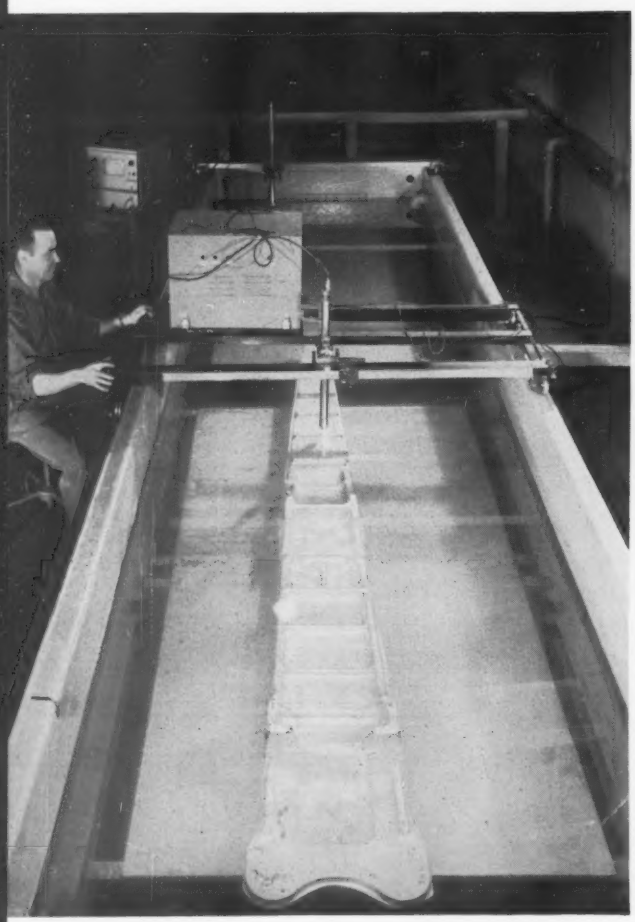


Fig. 5. In this ultrasonic immersion test, waves are reflected by any mechanical discontinuities in the material.

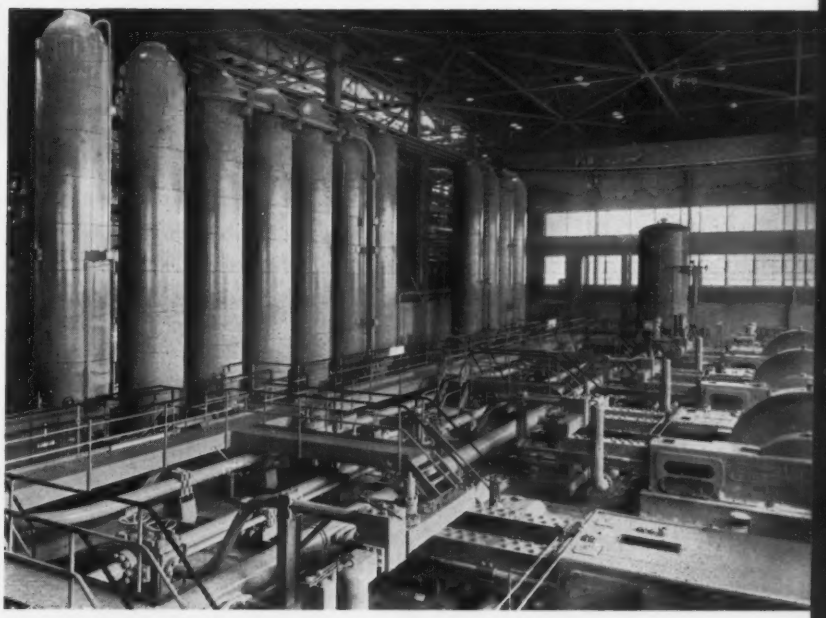


Fig. 6. Water in the eleven accumulator bottles is compressed to 300 atmospheres (4500 pounds per square inch).

per square inch, is admitted to the main cylinders of the press, lowering the upper entablature. When the upper die member contacts the billet, forging resistance sets in, and the operator introduces fluid from the bottles at a pressure of 4500 pounds per square inch. The pressure brings the dies closer together, producing a plastic flow of the metal.

Finally, the members are fully closed by fluid supplied by the intensifiers at a pressure of 6750 pounds per square inch. Then, to raise the upper entablature, accumulator water at a pressure of 4500 pounds per square inch is forced into the pull-back cylinders. Simultaneously, the fluid in the main cylinders drains into the prefill tanks, and the excess is by-passed to the gravity tank. In preparation for the next forging cycle, the accumulator bottles are automatically refilled by the pumps.

Die-making facilities at the plant are complete and modern, and were planned with the capacities of the new presses in mind. One of a battery of Pratt & Whitney Keller die-sinking machines is shown in Fig. 7. Here, the contours of a plaster master are being automatically reproduced in a solid forged steel die-block.

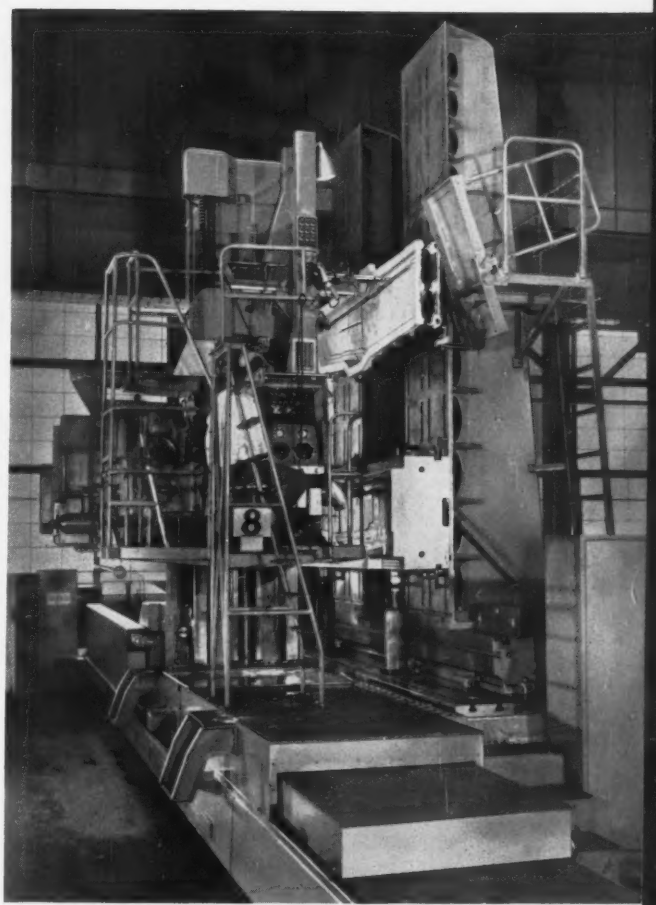
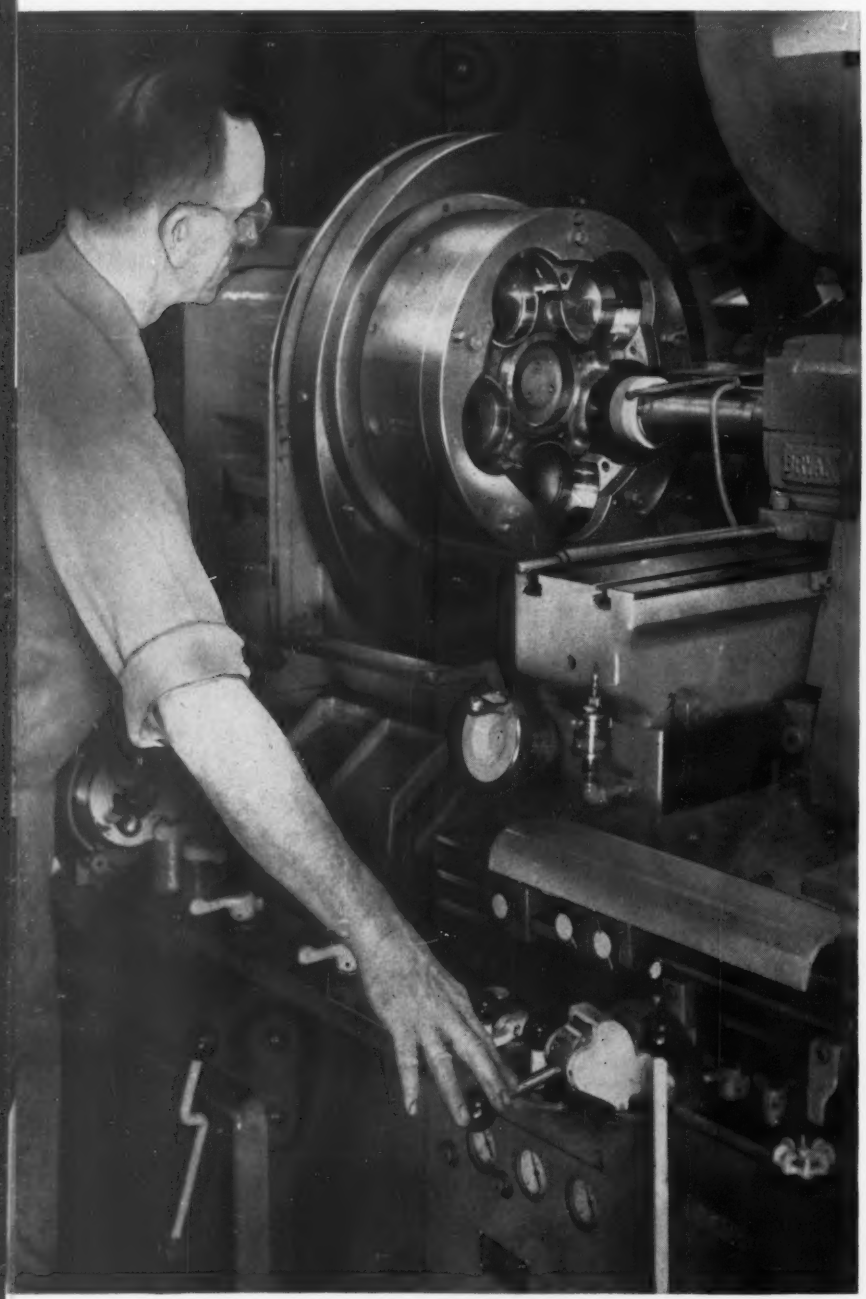


Fig. 7. Contours of the plaster master are reproduced in the die-block by automatic movements of the die-sinking spindle.

Producing Allison

A high-horsepower, low-weight aircraft engine having a gas turbine driving the propeller is being built for commercial applications. Techniques employed in producing the precision components for this new engine will be described in this article



By J. C. FETTERS

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Allison Division
General Motors Corporation
Indianapolis, Ind.

Turbo-Prop Engines

HIGH power, low weight, small diameter, and low fuel cost are the outstanding features which make the turbo-prop aircraft engine a practical choice for commercial transport. The turbo-jet engine, with its high efficiency at high speeds and altitudes, is a natural selection for long-distance travel where the advantage of speed outweighs the economic factor of cost per ton-mile. However, for short or medium-range flights, the turbo-jet is less economical because of lower power efficiency at take-off, and the high rate of fuel consumption at low altitudes.

Airplanes powered with turbo-prop engines will provide high speeds (approximately 450 miles per hour) with good load-carrying ability and economy at all altitudes. Such planes can land or take off on small airfields, carry passengers comfortably for short and medium distances at higher speeds, and carry large pay loads of cargo economically.

In the turbo-prop engine, air is compressed and delivered to the combustion section of a gas turbine. Here, fuel is added and the mixture of fuel and compressed air is burned. Energy released by the expanding gases is absorbed by the turbine which converts the energy to shaft horsepower and drives the propeller (through a reduction gear-box), the compressor, and the engine accessories. About 10 per cent of the turbo-prop engine's propulsive force is jet-thrust, but the remainder comes from the propeller.

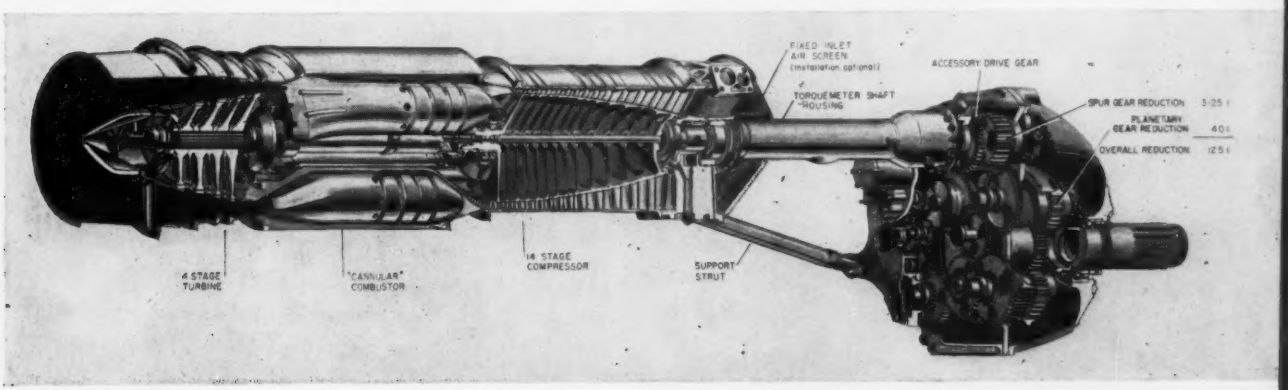
Allison started development of turbo-prop engines during the latter part of World War II. This resulted in the first flight of an Allison turbo-prop engine which was mounted in the nose of a converted Boeing B-17 bomber. Since then, such engines have powered in flight twenty-one aircraft of nine different types. The Allison T40 turbo-prop engine is now used in production models of the Convair R3Y Tradewind water-based transport, and was selected by the U. S. Navy to power the experimental VTO (vertical take off) aircraft built by Convair and Lockheed. A new and greatly improved turbo-prop engine, the T56, is being tested in Convair YC-131C aircraft and Lockheed C130 "Hercules" four-engine cargo transports.

As a result of this research, development, and testing, General Motors—through the Allison Division—is now entering the commercial aviation field for the first time with a commercial model of the T56 engine having Aeroproducts propellers. This turbo-prop engine, Model 501-D10, develops more than 2.3-H.P. per pound of weight, and has a frontal area of only 6 square feet—less than half that of current piston engines. As shown in Fig. 1, the internal-combustion gas-turbine power section is connected to a reduction-gear assembly by an extension shaft and a supporting structure.

The 12.5 to 1 ratio reduction-gear assembly reduces the power-section shaft speed of 13,820 R.P.M. to the rated propeller-shaft speed of 1106 R.P.M. This speed step-down occurs in two stages: a primary step-down of 3.125 to 1 by a spur gear set; and a secondary step-down of 4.0 to 1 by a planetary gear set.

A fourteen-stage, axial-flow compressor is

Fig. 1. Allison turbo-prop engine which develops more than 2.3-HP. per pound of weight has a fourteen-stage compressor and four-stage turbine.



used to handle over 30 pounds of air per second. The compression ratio is in excess of 9 to 1 at rated power under standard sea-level static conditions. The turbine-rotor assembly contains four stages for absorbing energy and driving the compressor and reduction-gear assembly. Rated take-off horsepower for the turbo-prop engine is 3750, with a weight of 1610 pounds.

Present low-volume production requirements for the turbo-prop engine dictate the use of flexible manufacturing methods and standard machines whenever possible, so that the machines can be employed for the part-time manufacture of components for other engines. Also, precision techniques must be employed to maintain the exacting tolerances specified for various engine parts. For example, gear-tooth forms must be held to ten-thousandths of an inch, and finishes of 20 micro-inches r.m.s. are required.

One precise part for the turbo-prop engine is a spline ring which forms part of the negative-torque signal unit in the reduction-gear assembly —acting as a safety device to uncouple the power section when the torque exceeds a pre-set amount. This ring, 17 5/8 inches in diameter and 1/2 inch thick, with a bore of 16 1/4 inches, is forged from AMS 6415 steel. Because of its thin cross-section, it is difficult to keep the ring flat and round. Faces must be held parallel within 0.002 inch. The outside diameter is maintained within plus or minus 0.001 inch of the required size, and the pitch diameter of the spline must be concentric with the true position of the ring axis within 0.002 inch total indicator reading.

Fig. 2. Internal helical splines in a ring for the reduction-gear assembly of a turbo-prop engine are finish form-ground on this gear grinding machine.

The ring forgings are cycle-annealed to remove stresses, and heat-treated to obtain a core hardness of 32 to 36 Rockwell C. A Blanchard rotary surface grinder is used to rough one flat face, and the other surfaces are rough-machined on Bullard vertical turret lathes. After stress relieving the spline rings again at a temperature between 350 and 375 degrees F. for two hours, the parallel faces are rotary-ground, and the ring forgings are semi-finish turned and bored. The peripheries of the rings are ground, and thirty- six holes, 21/64 inch in diameter, are drilled through each ring on a 17-inch bolt circle. Faces, periphery, and the bore of each ring are ground after again stress relieving.

Internal helical splines in the rings are rough-formed on Fellows shapers, leaving 0.014 to 0.015 inch of stock on each tooth for removal in subsequent grinding. Each ring has 107 teeth of 6.5532 pitch, 35-degree right-hand helix angle, 17.5216-degree pressure angle, and 0.2405 inch arc-space width. Two dowel holes are drilled and reamed to a diameter of 0.3145 inch, and the thirty-six holes previously drilled are reamed to a diameter of 0.3465 inch and countersunk. After regrinding the faces, periphery, and bore, both faces are lapped flat and square.

The helical splines are finish form-ground on a Red Ring helical gear grinding machine, Fig. 2, made by National Broach & Machine Co. Each ring is located on two dowels and against a lapped face in a special fixture supported between centers. The machine has an accurately ground master lead-bar operating through an anti-backlash saddle nut, with the work-drive headstock coupled through an index-plate to one end of the bar. As the lead-bar reciprocates, the spline ring rotates with it. The automatic indexing mechanism is an integral part of the live-center headstock.

Grinding of the splines is done with a vitrified-bond, aluminum-oxide abrasive wheel, 6 inches in diameter by 3/8 inch wide, of 60 grain size and J hardness. The wheel is precision dressed by two diamonds. The dresser head carries two horizontal spindles, pivoted to give two rotary motions. Each spindle carries a diamond-tipped dressing tool at one end, and a tracer at the opposite end. The tracer points bear against a mas-

ter-tooth form, thus causing the diamonds to duplicate the contour of the master on the wheel.

Another precise part for the reduction-gear assembly of the turbo-prop engine is the highly stressed internal ring gear having an outside diameter of 16 3/4 inches, a bore of 14 3/4 inches, and a width of 4 1/2 inches, including a skirt 2 1/2 inches wide by only 0.094 inch thick. This gear is forged from AMS 6260 steel, and a stock removal of at least 1/8 inch from all surfaces is required to uncover possible defects. Width of the gear must be maintained within plus or minus 0.0005 inch, and a finish of 32 micro-inches r.m.s. is specified for all surfaces. A permanent record is kept of the serial numbers assigned to and etched on the gears.

Each ring gear has ninety internal teeth of 6 pitch and 25-degree pressure angle. The teeth are cut on a Fellows internal gear shaper. Roots of the teeth are finish-ground (including fillets having a radius of only 0.035 inch) and the involute forms of the internal teeth are semi-finished on a grinder made by the Gear Grinding Machine Co. When the involute teeth are subsequently finish-ground on a similar machine, specified protuberances are formed where the root fillets join the involute surfaces.

The abrasive wheels used on these gear grinding machines are precisely dressed to the exacting tolerances specified by means of Hoglund Magni-Form contour wheel dressers, such as the one shown in Fig. 3. In the illustration, the cover has been removed from the dresser to show the contour templates, which, in conjunction with a contour-ratio cam having a 3 to 1 ratio, control the hydraulically actuated dresser for continuous dressing with two diamonds in one automatic cycle. Each diamond dresses one involute side, the adjoining rounded corner, and one-half the periphery of the wheel, thus insuring perfect blending.

Finish contour-turning of the ring gear is done on a Sidney lathe, Fig. 4, equipped with a "Fluid Tracer." In this set-up, a flat template clamped in a holder on the rear of the lathe is used, and a stylus in contact with the template controls the contour turned on the gear periphery. Rate of cross-feed of the tool is regulated by a hydraulic valve located on the tracer head, while longitudinal movement of the carriage is governed by a

Fig. 3. Magni-Form contour wheel dresser has templates and a contour-ratio cam to control two hydraulically actuated diamonds in an automatic dressing cycle.

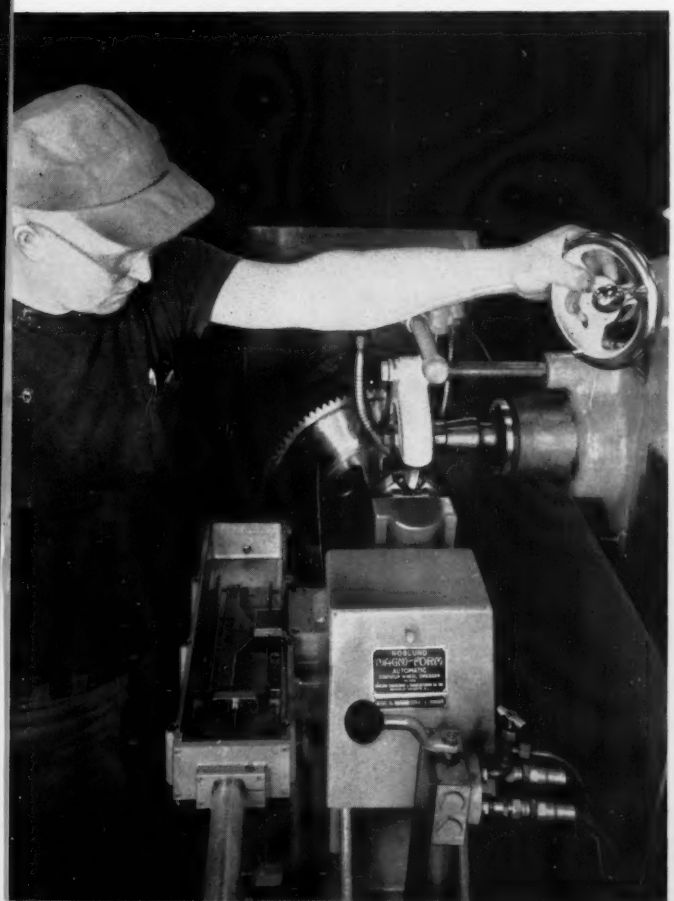
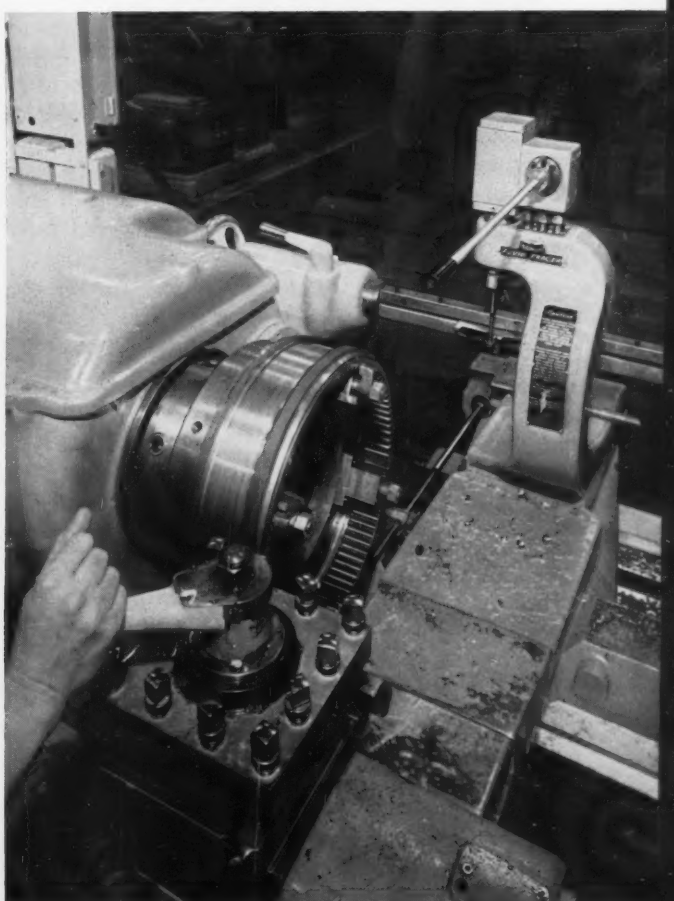


Fig. 4. Highly stressed internal ring gear, forged from AMS 6260 steel, is finish contour-turned on this lathe equipped with a hydraulic tracing attachment.



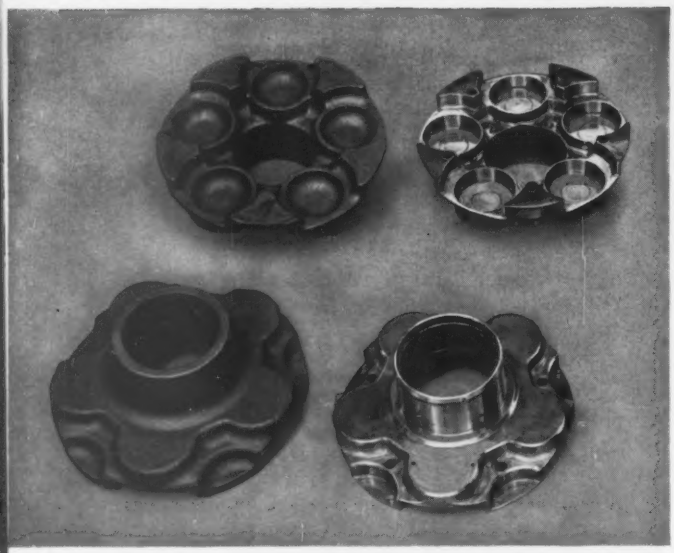


Fig. 5. A total of 49 pounds of metal is removed in machining each forged-steel planet-gear carrier. Front and rear views of a forging are seen at left.

hydraulic clutch and cylinder located at the right-hand end of the lathe bedways.

Planet-gear carriers for the reduction-gear assemblies of the turbo-prop engines are forged from AMS 6415 steel. Each carrier, consisting of a front and a rear half, is approximately 14 3/16 inches in diameter by 6 inches long and holds five planet gears. Some idea of the amount of machining required and the quality of finish obtained in producing the carriers is realized from Fig. 5, which shows front and back views of a rear-half forging (left) and similar views of a completed part. The rear-half, planet-gear carrier forging weighs 64 pounds, and the finished piece only 15 pounds—necessitating removal of 49 pounds of steel chips.

Bores of the five planet-gear pockets in each carrier half must be equally spaced and located within 0.001 inch of true position. The flat faces of the five "islands" formed between adjacent gear pockets must be in the same plane and parallel within 0.001 inch total indicator reading. Also, the ten dowel holes and five body-fit bolt holes have to be equally spaced and accurately located within 0.001 inch. A finish of 32 micro-inches r.m.s. is specified for all surfaces of the carriers with the exception of the gear pockets, which must have a surface finish of 20 micro-inches r.m.s.

After rough-machining all surfaces of the planet-gear carriers on Bullard vertical turret lathes, the forgings are further lightened by milling on a Cincinnati tracer-controlled Hydro-Tel, Fig. 6. On this machine, movement of the tracer finger around the contour of the template, mounted on the right-hand end of the machine table, is hydraulically relayed to the milling cutter in contact with the forging. Two different cutters complete the part in two passes.

Bores of the five planet-gear pockets in the rear carrier half, as well as the thrust shoulders adjacent to these pockets, are ground on the Bryant internal grinding machine seen in the heading illustration. The carrier is pre-mounted on a plate, locating from the main bore of the part, against a previously ground face, and (radially) from one of the dowel holes; and the plate is placed in a special pot type indexing fixture mounted on the headstock of the grinder. The gear pockets are offset 0.0045 inch with relation to the center line of the true axis of the carrier, to compensate for twist under load during operation of the turbo-prop engine.

Fig. 6. Tracer in contact with template mounted on right-hand end of tracer-controlled milling machine guides cutter in lightening the planet carrier.

Fig. 7. Special air gaging unit developed and built by Allison for final inspection of ground gear pockets. A dial indicator is provided for each pocket.

Approximately 0.017 inch of stock (0.0085 inch per side) is ground from the bore of each gear pocket. A vitrified-bond aluminum-oxide abrasive wheel, 3 3/4 inches in diameter by 2 inches wide, of 60 grain size and K hardness is used. Each wheel can be employed to grind about fifty pockets. Bore size is maintained between 3.9370 and 3.9380 inches; pocket depths are held to 2.148 inches, plus or minus 0.001 inch; and fillets at the bottoms of the pockets are ground to radii between 0.040 and 0.060 inch.

Final inspection of the ground gear pockets is performed on a special air gaging unit, Fig. 7, designed and built by Allison. A dial indicator and gaging spindle with a single air jet is provided to inspect each pocket. The inspector manually lifts and rotates each spindle while observing the positions of the needles on the graduated dials of the gages. True position of the pockets, which are located on a 10-inch bolt circle, must be maintained within 0.001 inch.

The thin-section compressor housing for the turbo-prop engine is of split construction, consisting of upper and lower longitudinal halves made from AMS 5510 and 5645 steel weldments. End, top, and side surfaces of the manufacturing lugs on the weldments, which are used for locating purposes in all subsequent machining operations, are accurately milled on the Cincinnati Hydro-Tel seen in Fig. 8. Elaborate work-holding and targeting fixtures, shown on the left-hand end of the machine table, are used to qualify the work-pieces prior to milling.

The housing is located in the fixture on its split-line surface, and against an inner flange face. Then, the jack-screws in the special fixture are used to make the part level, and to adjust it to the specified height. Boss locations, wall thicknesses, manifold pads, and the contour of the housing are checked by the various pins in the targeting fixture and a sweep-arm equipped with a dial indicator. Parts not passing this inspection are returned to the vendor. Satisfactory housings are milled, after removing the targeting fixture.

Compressor wheels for the turbo-prop engine

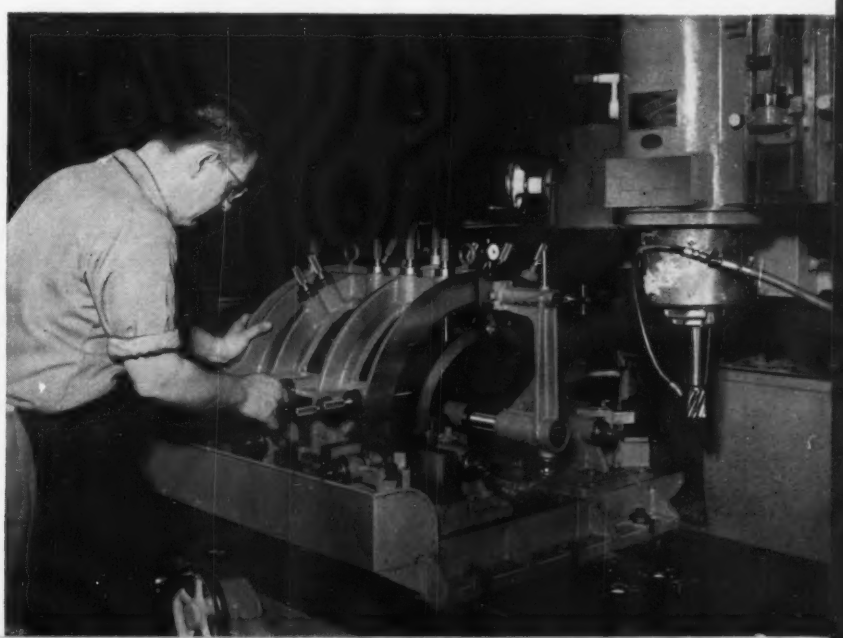


Fig. 8. Special work-holding and targeting fixtures are used to check boss and pad locations, wall thickness, and contour of housing prior to milling.

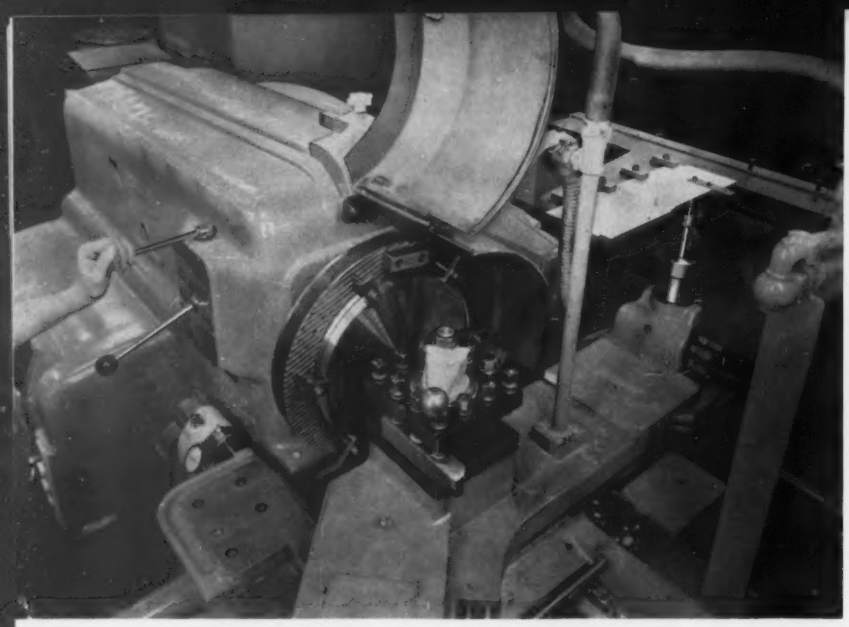


Fig. 9. Webs of forged-steel compressor wheels are contour-faced on this tracer-controlled, hydraulic duplicating lathe having variable-speed drive.

vary from 7 7/8 to 13 1/4 inches in diameter, and hold from thirty-three to ninety-one blades. All fourteen wheels in each engine are forged from AMS 5613 steel, heat-treated to obtain a hardness of 32 to 36 Rockwell C. A smooth finish (32 micro-inches r.m.s.) is specified for all surfaces. The webs of the compressor wheels are contour-faced on American tracer-controlled, hydraulic duplicating lathes such as the one seen in Fig. 9. On these machines, the tool-slide operates at an angle of 45 degrees with the axis of the work. Hydraulic oil under a pressure of 300 pounds per square inch is supplied to a tracer valve. As the stylus traverses the flat template mounted on the rear of the lathe, metered amounts of oil from the valve enter a hydraulic cylinder attached to the tool-slide, thus controlling the movement of the cutting tool.

From 1/16 to 3/16 inch of stock is removed from each compressor-wheel web face in two cuts. The webs have a taper of 1/8 inch per inch. During facing, the rotational speed of the compressor wheel is automatically varied from 100 to 318 R.P.M. by means of a Century variable-speed driving unit. The wheels are clamped to a faceplate which is mounted on the headstock, and they are located on their bores and in contact with their rim faces.

Fig. 10. A 15-ton, 90-inch stroke vertical broaching machine is used to cut serrated slots in the rims of the turbine wheels.

The four turbine wheels for each turbo-prop engine vary from 11 to about 13 5/8 inches in diameter and hold from 65 to 102 blades by means of serrated dovetail slots. The wheels are forged from a special heat-resistant stainless steel, and the forgings are inspected prior to machining by means of an ultrasonic testing unit built by Sperry Products. After rough machining, the wheels are tested by spinning at 20,000 R.P.M. for five minutes.

Serrated slots are cut in the rims of the turbine wheels on a Lapointe 15-ton vertical broaching machine, Fig. 10, having a 90-inch stroke. The wheel is mounted on an indexing fixture, locating on the pitch diameter of the previously splined bore by means of an expanding splined arbor, and against one face of the wheel rim. Clamping is accomplished with a spider clamp

and back-up plate. The slots must be equally spaced around the wheel rim with a total accumulative spacing error of only 0.005 inch.

Serrations in the roots of the turbine blades are rough- and finish-ground on Thompson dual-wheel, form-grinding machines such as the one seen in Fig. 11. Two blades are loaded at a time in a block type shuttle fixture, locating from the airfoil surfaces of the blades. The loaded fixture is automatically fed into position and reciprocated vertically between the two abrasive wheels, 14 inches in diameter by 5/8 inch wide, thus simultaneously forming serrations on both sides.

Approximately 0.085 inch of stock is removed in rough-grinding the blade-root serrations, and 0.025 inch more is removed in finish-grinding Vitrified-bond, aluminum-oxide abrasive wheels of 180 grain size and K hardness are used for both rough- and finish-grinding. The right-hand wheel is dressed by means of a cam-controlled diamond after grinding each pair of blades. At the same time, the left-hand wheel is crush-dressed to the required contour by a hardened steel roll that is rotated against the wheel at reduced speed. After grinding from 80 to 100 blades, the crush roll is redressed by means of the diamond-dressed, right-hand wheel.

One exception to the use of standard, general-purpose machines is in drilling the cast magnesium, front and rear gear cases. For this purpose, a Buhr three-station transfer machine, Fig. 12, is employed. The machine consists essentially of three multiple-spindle, double-end units, tied together by a roller transfer table on which the pallet type fixtures holding the gear-case castings are manually pushed from station-to-station.

For drilling the rear reduction-gear case of the turbo-prop engine, only two of the three stations on the machine shown are required. A total of 143 holes, varying from 0.245 to 0.364 inch in diameter, are drilled in this part, 76 of these holes being drilled by tools on the right- and left-hand heads of the first machine unit, and 67 on the second unit. All three units of the transfer machine are used for parts on other engines, and similar machines for reaming various parts.

Fig. 11. Serrations are ground in both sides of blade roots, two blades at a time, on this dual-wheel form-grinding machine.

Fig. 12. Transfer machine having three multiple-spindle, double-end drilling units is employed to drill 143 holes in reduction-gear case of turbo-prop engine.

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Unique Machines Perform Operations on Jet-Engine Parts

MACHINE tools and other equipment of standard design are employed in the shops of the Ryan Aeronautical Co. to the greatest possible extent. There are, however, instances when production problems make it desirable to develop special equipment. In such cases, the Ryan Production Engineering Division is generally called upon to design and build equipment for the specified job.

Such a problem arose in planning production procedure for combustion-chamber inlet housings required on Curtiss-Wright J-65 jet engines. Typical housings are seen at the beginning of a machine production line in the heading illustration. Three unique machines were developed that will be here described. Each of these machines utilizes standard cutter-heads and some other units obtained from commercial sources; but

bases, indexing tables, and other principal and minor components were built in the Ryan toolroom.

The combustion-chamber inlet housings are made completely either from No. 321 stainless steel or from Timken 1722A alloy. The housings consist of two forged, or rolled, rings that serve as flanges, a formed circular sheet-metal "skin" between the flanges, and twenty-seven precision castings which provide bosses on the inside and outside of the skin.

The flanges are turned from forgings on a vertical turret lathe ready for welding to the opposite ends of the skin. The latter is formed on a special hydraulically actuated mandrel of Ryan construction, after which it is heat-treated and returned to the mandrel for final forming within close tolerances. The expanding mandrel is seen in Fig. 1. The preliminary skin is formed either from sheet metal or else welded from strip material before the performance of the first operation on the expanding mandrel.

Welding the two flanges to the skin is performed automatically by employing the Heliarc process with the parts mounted on an indexable positioner, as shown in Fig. 2, although the photograph shows a different assembly than a chamber inlet housing. Next, twenty-seven holes are pierced around the skin with the die equipment seen in Fig. 3, which is mounted on a Warco 400-ton geared press. Three holes for one series of precision castings are pierced at a time, two of these being round holes 2 inches in diameter, and the third, an irregular hole approximately 5 3/4 inches long by 2 inches in maximum width. Piercing is effected as the descending ram pushes wedges downward to actuate punches radially in a horizontal plane. The work is indexed nine times in piercing the twenty-seven holes. Each punch is spring-backed to make it recede automatically when the press ram returns to its upper position.

The next step in the manufacturing procedure is to weld the precision castings to the skin. The castings are first tack-welded accurately as to location, after mounting and clamping them on a special fixture, in the manner illustrated in Fig. 4. They are permanently attached to the skin by Heliarc welding, with the parts mounted on the fixture in Fig. 5 for welding the bosses of the precision casting to the outside of the skin and on the fixture in Fig. 6 for welding the bosses to the inside of the skin. These operations are performed under a pressure of 1200 pounds per square inch.

Heavy copper castings are butted against the precision castings to support them adequately, so as to guard against warpage and to help dissipate the heat that develops in this operation. This welding procedure applies only to the stainless-steel housings, it being unnecessary to provide copper backing for the Timken 1722A alloy parts even though they are also Heliarc-welded.

The assembled housings are transferred to a vertical turret lathe for facing and turning the flanges to specified dimensions within a total tolerance of 0.002 inch. Next, nine internal extensions on the housings are faced by employing the Lodge & Shipley T-lathe illustrated in Figs. 7 and 8. Four surfaces are machined to specified dimensions within plus or minus 0.0025 inch. The housings are then transferred to a production line on which are installed three special machines of the category referred to at the beginning of this article.

The first of these machines has four Master milling heads, as seen in Figs. 9 and 10. This machine takes eighty-seven facing cuts on the precision castings, holding specified dimensions within a total tolerance of 0.003 inch. Cuts are taken at four different angles. This machine is

Fig. 1. Expanding mandrel employed for forming the thin skin later assembled between two flanges

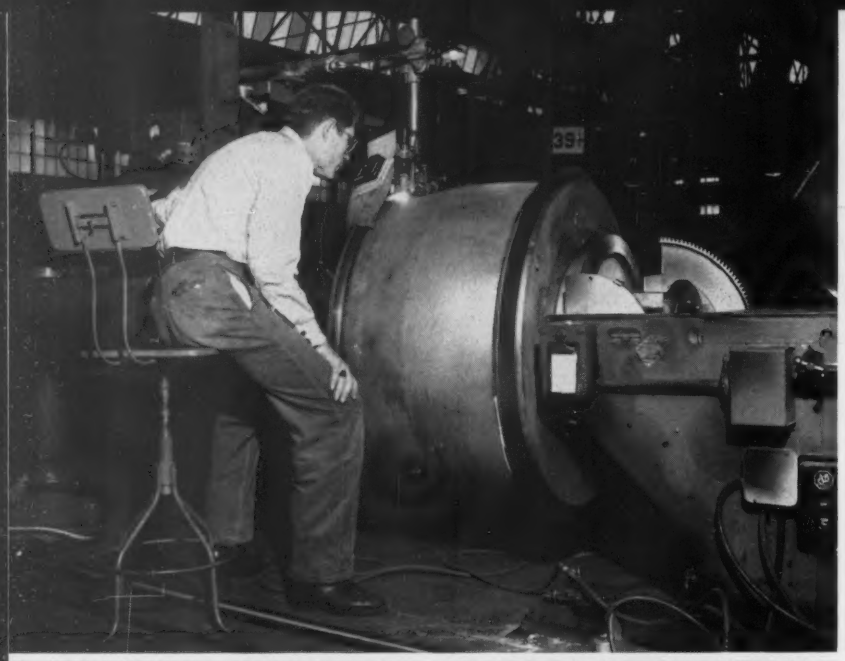
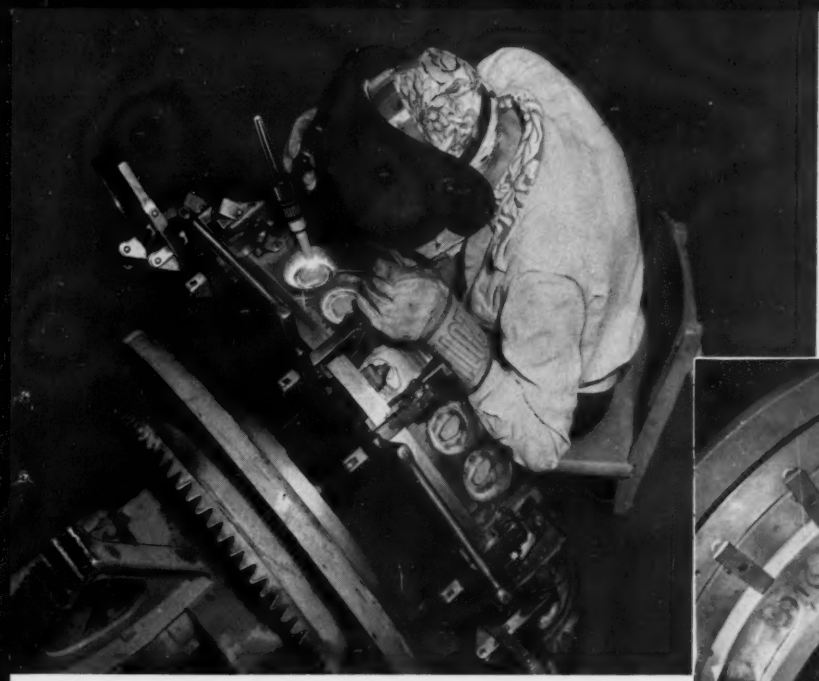


Fig. 2. Type of machine employed for the automatic Heliarc welding of the skin to the two flanges of chamber inlet housings

Fig. 3. Die equipment used on a geared press for piercing twenty-seven holes around the skin to receive precision castings

Fig. 4. Tack-welding the precision castings on the chamber inlet housing to locate them accurately for solid welding in a subsequent operation



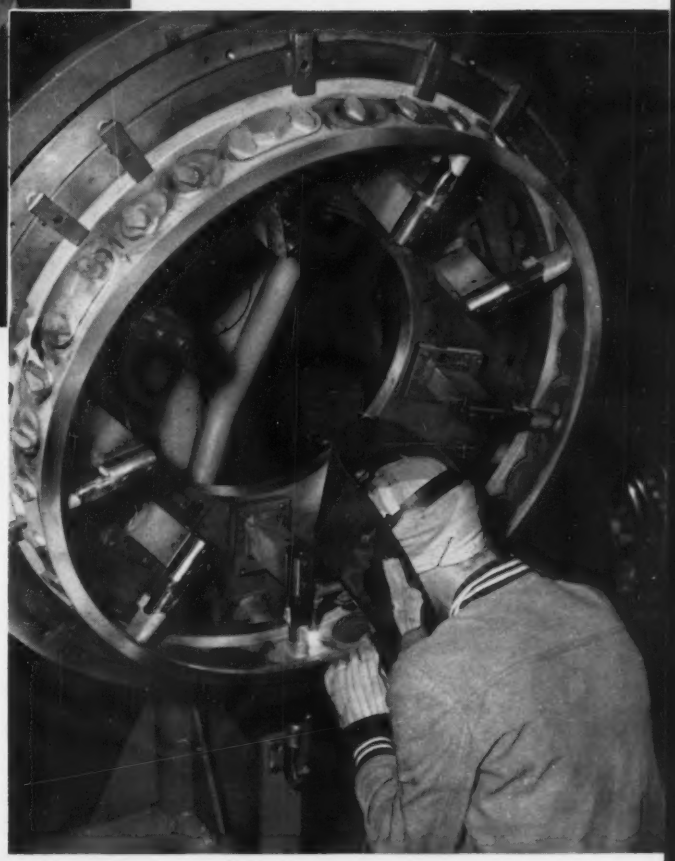


Fig. 5. (Above) Welding the bosses of the precision castings to the outside of the skin

Fig. 6. (Right) Fixture set-up used for solidly welding the bosses of the precision castings to the inside of the skin

Fig. 7. (Below) Nine internal extensions on the housings are faced on a Lodge & Shipley T-lathe

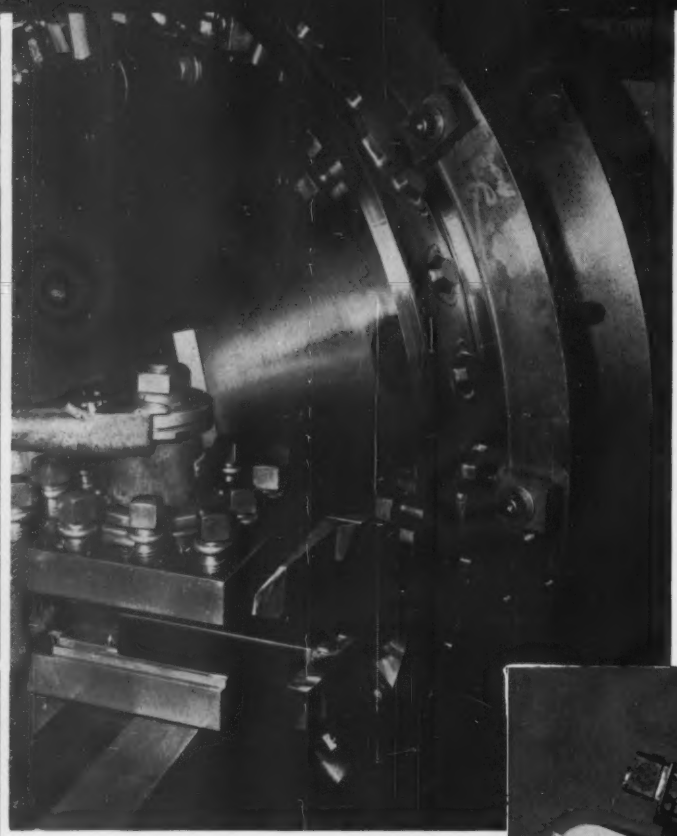
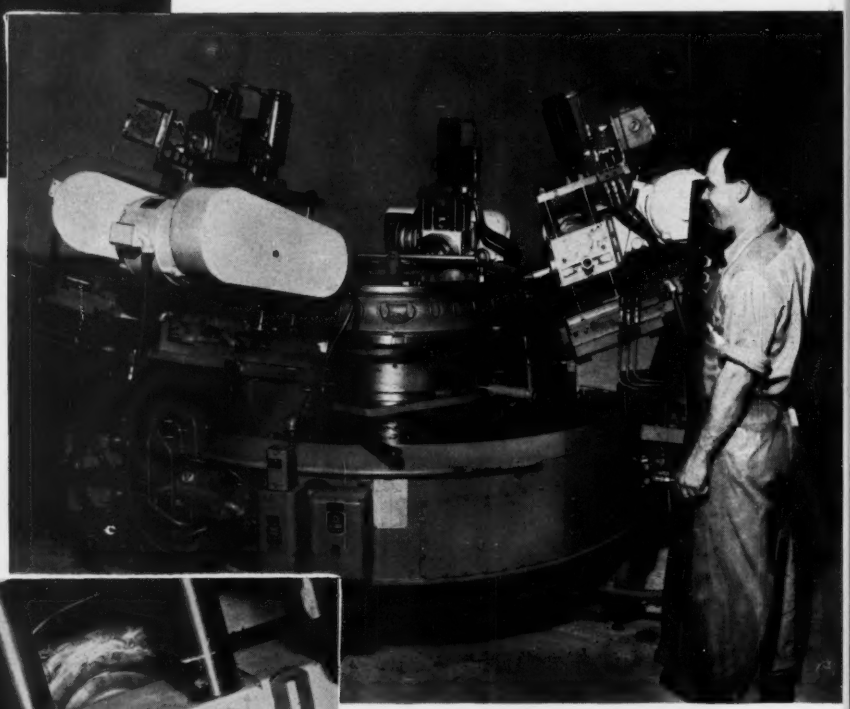


Fig. 8. (Above) Close-up view of the operation in Fig. 7, showing tools and internal extensions being faced

Fig. 9. (Below) Special Ryan machine which takes eighty-seven facing cuts on the precision castings, holding specified dimensions within a total tolerance of 0.003 inch



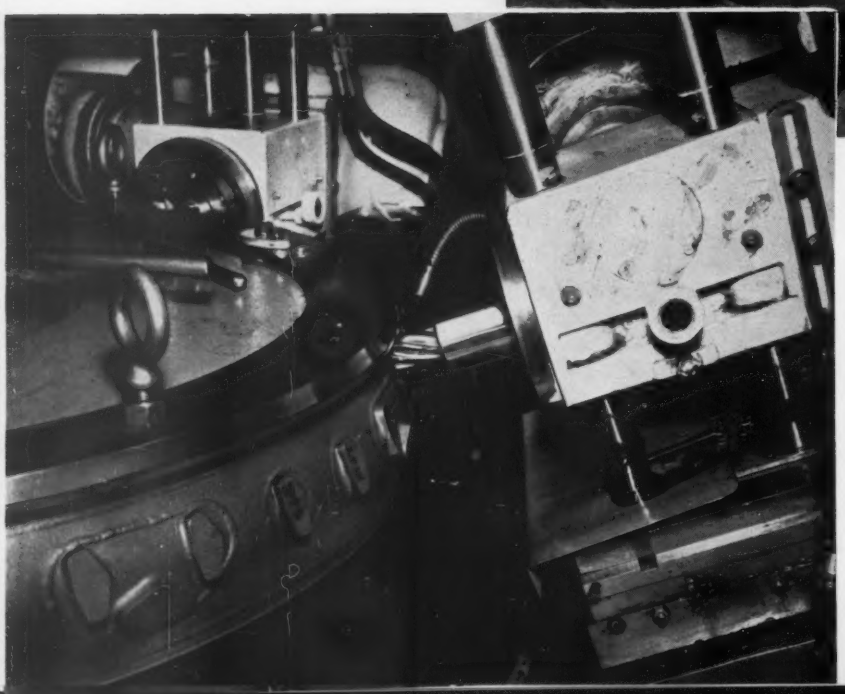


Fig. 10. (Left) Close-up view of one of four face-milling cutters on the machine shown in Fig. 9. Each of the cutters mills at a different angle.

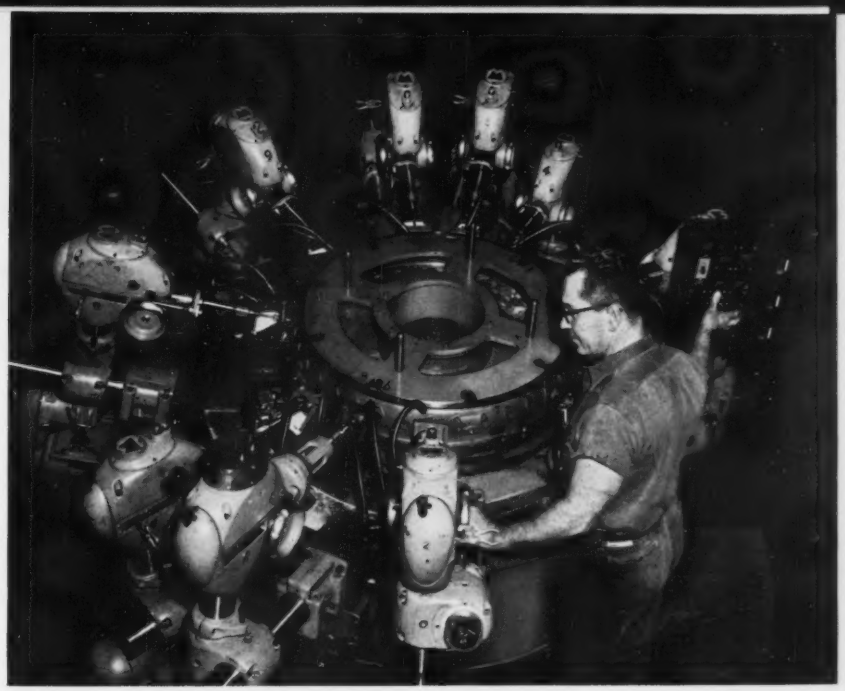


Fig. 11. Ryan-built special machine arranged with nine single-spindle heads for producing a total of 141 holes in the precision castings on the chamber inlet housing

also operated automatically except for manual indexing. The operation is performed in one hour as against an estimated time of eight and one-half hours that would be required on single-spindle standard machines.

The machine shown in Fig. 11 is provided with nine Magna single-spindle drill heads for producing 141 holes in the precision castings of each housing. The smallest of these holes is 0.213 inch in diameter and the largest 11/16 inch. Except for indexing the work beneath the drill heads, the operation is performed automatically. It requires one and one-half hours to do the job as against seven and one-half hours with standard machines.

The final machine in this special group is illustrated in Fig. 12. It drills 150 holes in the flanges and mills sixty scallops 2 1/2 inches in diameter by 0.220 inch deep into the edge of one flange. Holes are drilled in both flanges, but the scallops are milled in one flange only. The milling cutters are driven by Kingsbury heads and the drills by Delta heads. It is necessary to index the work seventy-five times on this machine to perform the required operations on both flanges. The time per part is approximately one and one-half hours as against an estimated time of eight hours on standard machines.

The last major machining operation on the housings consists of tapping ninety-four holes (of 1/4 inch diameter) in the castings. This is performed on a Warner & Swasey precision tapping machine. The housing is mounted on an easily indexed fixture to facilitate the operation. The holes are tapped to a Class 3B fit.

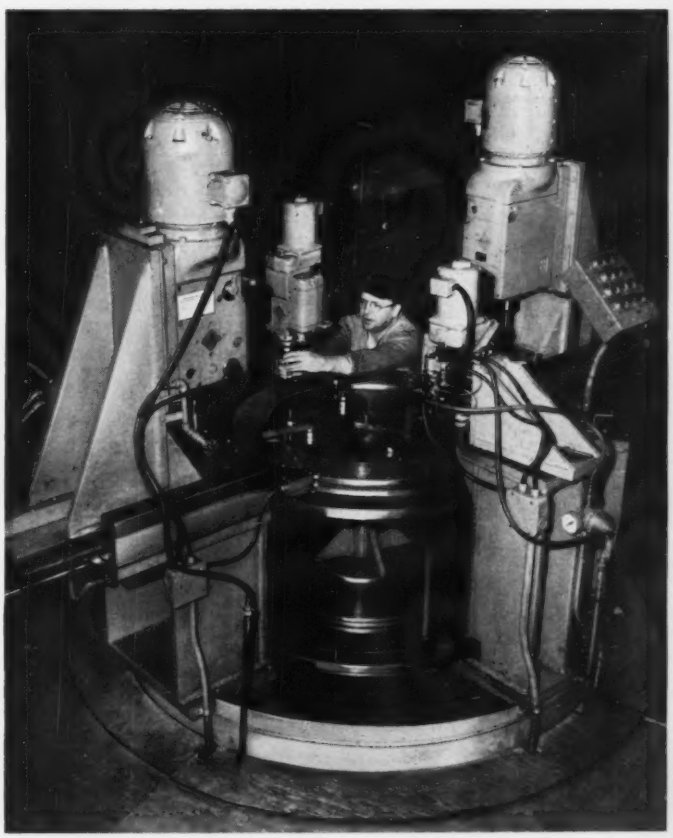
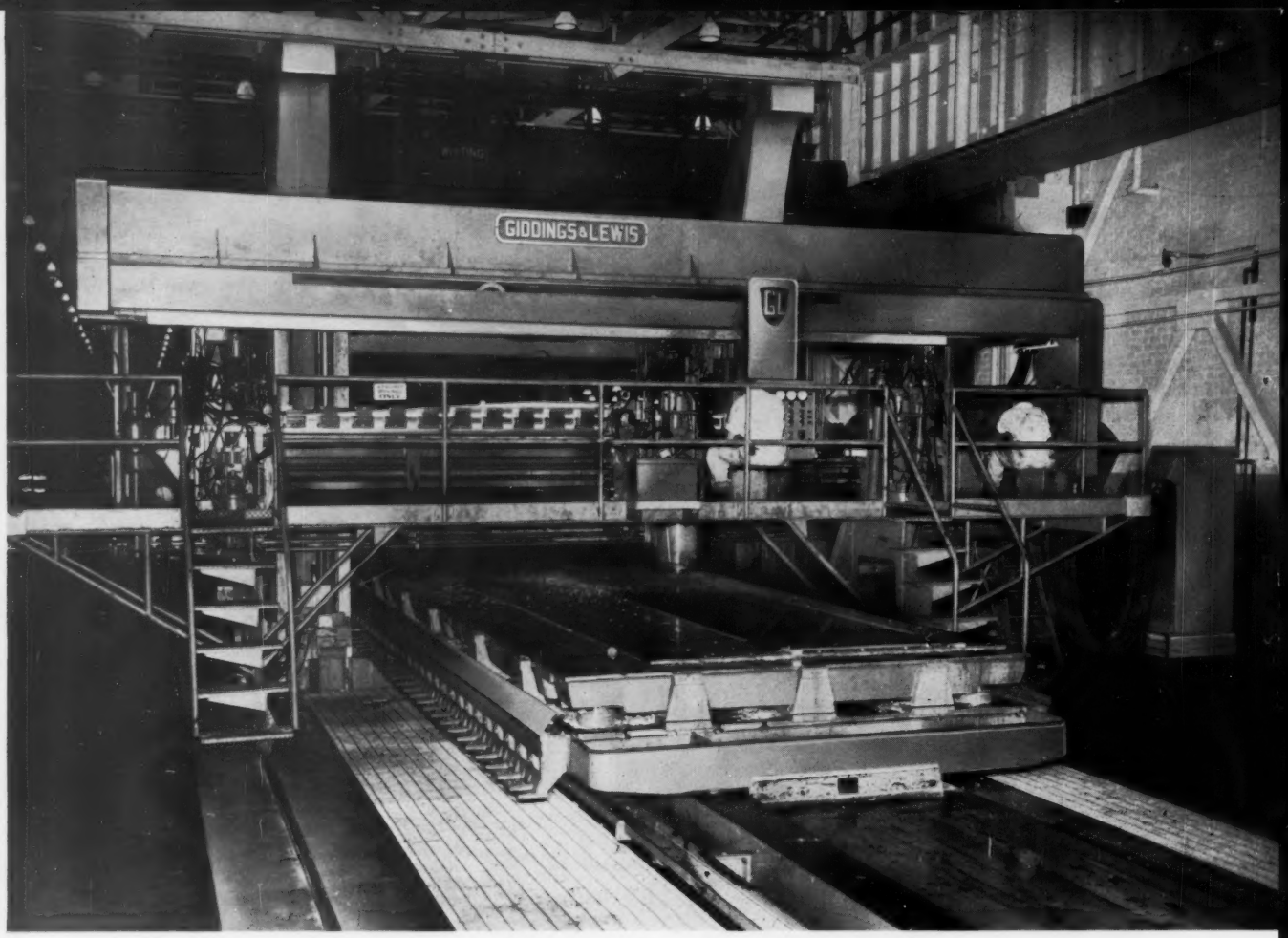


Fig. 12. Another special machine that drills 150 holes in the flanges and mills sixty scallops into the edge of one flange



THE introduction of high-performance jet aircraft with thinner wings designed to meet the new aerodynamic problems encountered in supersonic flight has resulted in many changes in aircraft structural design and manufacturing techniques. Among these is the trend toward integrally stiffened wing and tail surfaces and fuselage panels on one hand and improvements in riveting techniques of the more conventional sheet and stringer type of paneling, on the other.

There have been many advocates of large press programs in which hydraulic presses would forge structures complete with skin, stringers, rib chord members, and spar flanges. This construction method, however, is still in the future and has the disadvantage of the long die-sinking lead time, and, in addition, the drawback of incorporating the ever-present and necessary improvement changes.

To solve this problem the Douglas El Segundo plant is using two approaches that are relatively simple and most flexible with regard to change or modification. These are, a simple gang-milling method of machining stiffeners integrally with the skin from 75S aluminum-alloy plate and high-speed automatic riveting of extruded stringers to sheets.

The skin-milling method has shown great promise, especially for supersonic aircraft in which, due to the thinness of wings, skin thickness and stiffener thickness have increased to a point where riveting is less practicable. On these airplane models, stiffeners are integrally machined on wing panels by means of a 10-foot by 40-foot Giddings & Lewis skin- and spar-milling machine that can mill complete skin panels or wing spars at cutting rates in the order of 150 inches per minute. The average time of current components being milled is only approximately thirteen hours per unit.

To complement this Giddings & Lewis milling machine, giant equipment that will handle aluminum plates and sheets up to 40 feet long by 10 feet wide has been installed within the last year in the El Segundo plant of the Douglas Aircraft Co. to meet the new requirements of aviation. The same equipment, however, will also handle smaller sheets and plates on an economical basis, having been so designed because, without proper work planning, giant machines can be disastrously expensive. The equipment to be dis-

Douglas Equipped for Building Sonic and Supersonic Aircraft

By T. E. SPRINGER

Vice-President of Douglas Aircraft Co., and General Manager of the El Segundo, Calif., Division

cussed here includes a huge Giddings & Lewis skin- and spar-milling machine, big heat-treating and anodizing equipment, and a giant Verson press brake that measures over 40 feet between the end housings.

The skin- and spar-milling machine is shown in the heading illustration. It measures 90 feet long by 30 feet wide by 26 feet high and weighs 250 tons. It is sensitive enough to finish surfaces within tolerances of 0.0015 inch, completely by electronic control. A typical operation on this machine is to mill a wing section from a 1 1/4-inch thick plate 80 inches long by 76 inches wide. Such a single piece has replaced twenty-nine parts and eliminated 1300 rivets.

The machine is provided with three Onsrud cutting heads that are automatically guided by templates to produce the desired contours on the work. Two heads operate at 3600 R.P.M. at 100 H.P., and one in double ratio—3600 R.P.M. at 50 H.P. and 7200 R.P.M. at 100 H.P. The 40-foot long welded table can be fed on its ways at speeds up to 150 inches per minute beneath the cutterhead rail and a portable bridge that straddles the table. Two operators manipulate the push-buttons on General Electric panel control-boards as seen in Figs. 1 and 2.

The machine is equipped with twelve driving motors which supply a total of 350 H.P., exclusive of eighteen motors and generators that deliver the power supply. The table is driven by a 20-H.P. motor, and separate motors feed the cut-

Douglas F4D

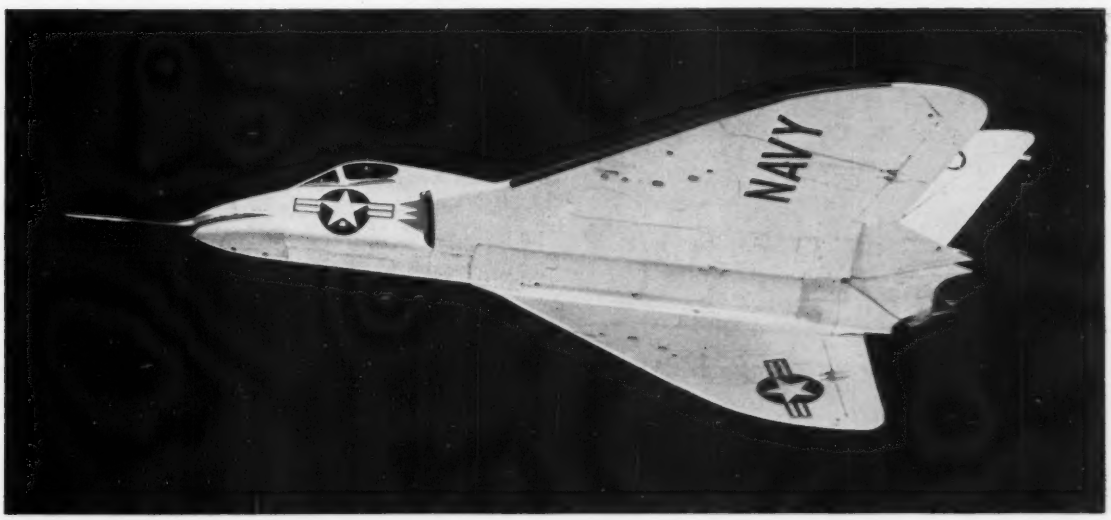


Fig. 1. Controlling the operation of one of the high-speed cutter-heads on the skin- and spar-milling machine from a portable bridge that straddles the machine table.

ting heads along their guide rails. Metal chips can be produced by the three cutting-heads at rates as high as 900 cubic inches per minute.

Work-pieces are fastened to the table by manual clamps and vacuum chucks. The operators adjust the cutting heads from the bridge for machining work-pieces to specified dimensions. One operator starts the necessary motors by means of thirty controls at his finger tips. The other operator focuses his attention on another larger panel which has 3 dozen multi-colored translucent push-buttons that control the variable motions of the three cutters. From their positions on the bridge, the operators can readily observe the performance of the cutters—as will be apparent from Figs. 1 and 2.

Fig. 2. Using straddle-milling cutters to produce integrally ribbed panels from thick aluminum plates.

Pins in the table which are actuated vertically by pneumatic means, lift the large sheets several inches above the table-top, as seen in Fig. 3, to facilitate removal of the work. Loading and unloading of large pieces is accomplished easily through the use of the unusual hoist sling seen in Fig. 4.

This huge machine is used extensively for thinning down and tapering sheets by means of large face-mills of fly-cutter design, such an operation being in progress in Fig. 1. Another typical operation consists of milling ribs in heavy plates by using straddle-milling cutters mounted on a horizontal shaft, as illustrated in Fig. 2.

Aluminum sheets coming from the Giddings & Lewis skin- and spar-milling machine are strengthened without any distortion by heat-treatment in a Knapp-Lee electric quick-quench furnace seen in Fig. 5. This unit, which needs only one man to operate it, is 38 feet high and is suspended from steel columns over a concrete tank that contains 38,000 gallons of water. The

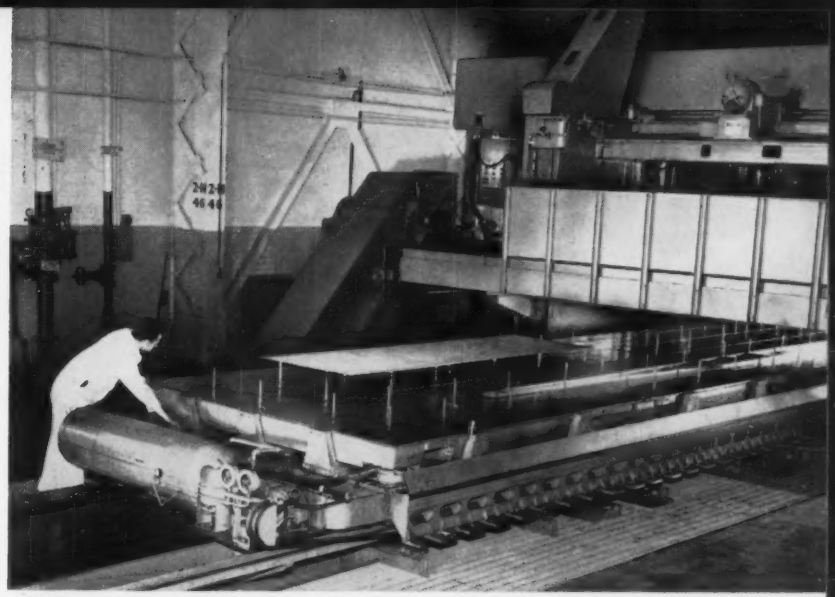


Fig. 3. Arrangement of pneumatic lifters on table of skin- and spar-milling machine which facilitates the raising of work-pieces upon completion of an operation.

furnace is a rectangular stainless-steel box 41 feet long, 4 feet wide, and 10 feet high. It is lined with insulating bricks and has more than 2000 feet of ribbon wiring. Parts can be heated to temperatures up to 970 degrees F.

Air is circulated within the furnace at the rate of 160,000 cubic feet per minute. This is accomplished by four blowers on top of the chamber and insures even distribution of the heat over the work. The furnace can be used as a single 40-foot unit for large parts, or it can handle smaller parts on an economical production basis.

The work-pieces and plates are loaded on the racks of a large, flat car at the front of the machine and then rolled into the heat-treating and quenching unit, as illustrated in Fig. 5. The operator then touches a push-button to actuate three rams for lifting the racks into the furnace, as shown in Fig. 6. Trap doors in the bottom of the furnace quickly roll together to seal out room air as the racks of work reach operation height.

Sounding of a buzzer tells the operator when the load of work has been heated in accordance with pre-set temperature and time controls, the heating period generally lasting forty-five minutes. Then the operator manipulates a button to open the trap doors and the load of work plunges downward into the water under the control of the

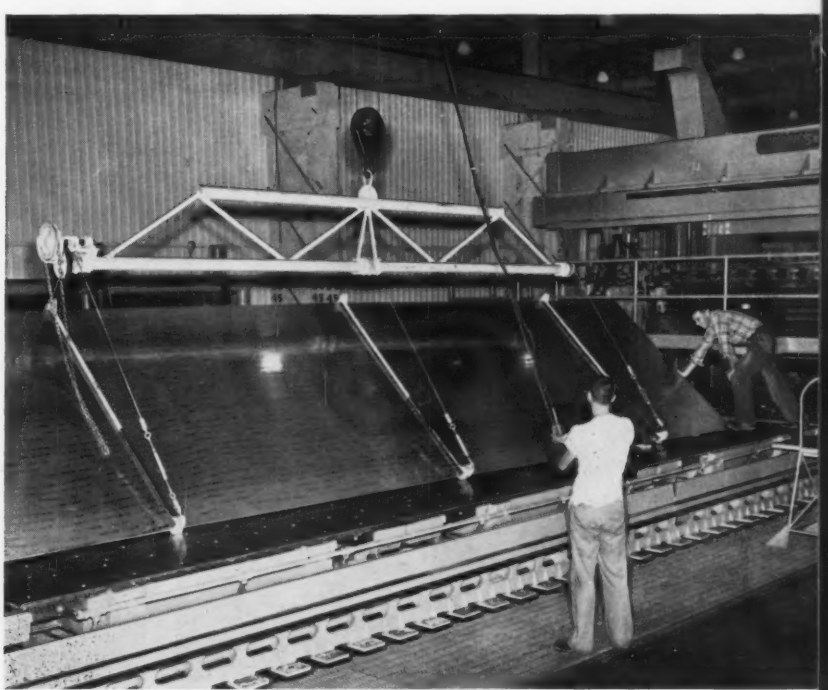


Fig. 4. Hoist sling which facilitates handling of large aluminum plates in operations on the skin- and spar-milling machine.

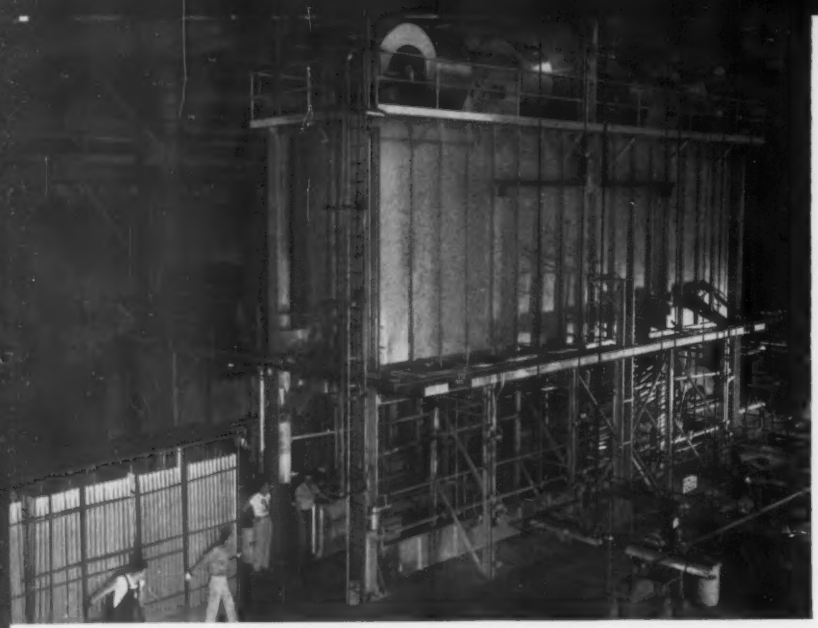


Fig. 5. Huge quick-quench heat-treating equipment which has a capacity for handling plates up to 40 feet long by 10 feet wide or a number of smaller panels on a quantity-production basis.

Fig. 6. Racks of work being raised by pneumatic rams into an overhead furnace for heating to temperatures up to 970 degrees F.

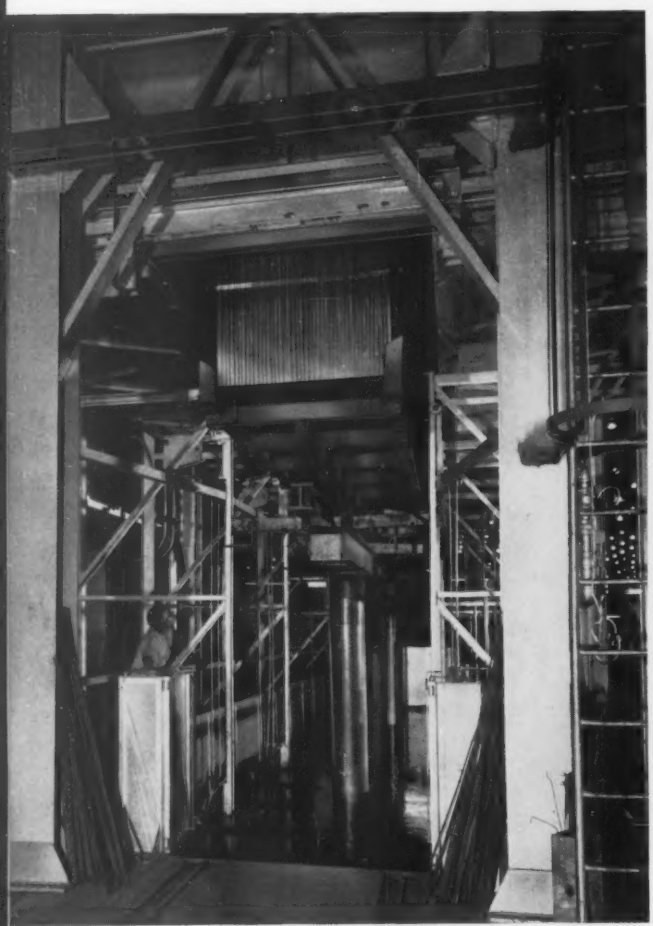
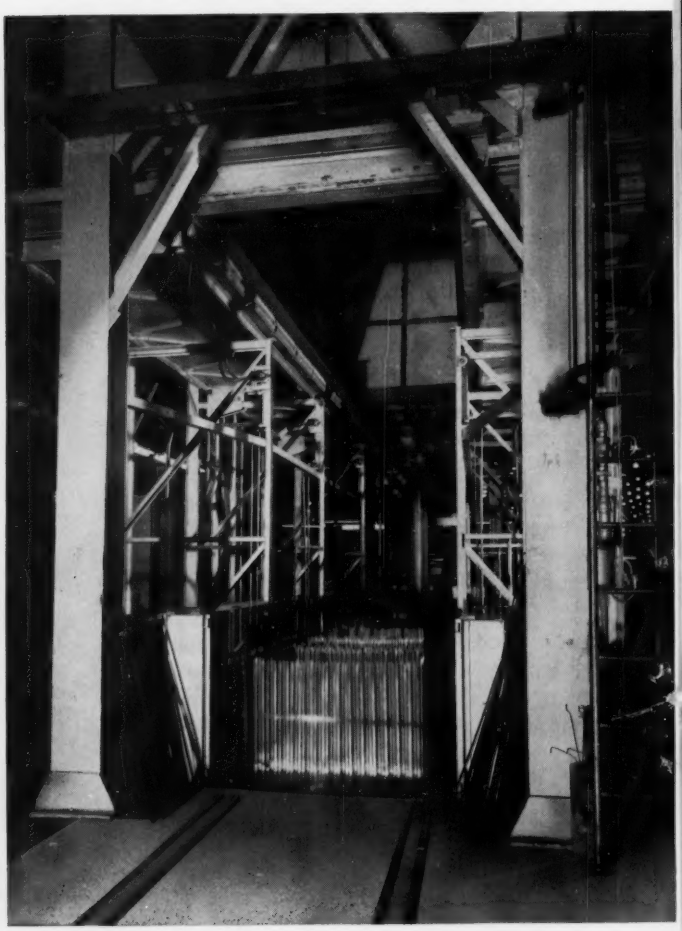


Fig. 7. When loads of work have been heated to the required temperature, they are plunged into a water tank at bottom of installation.



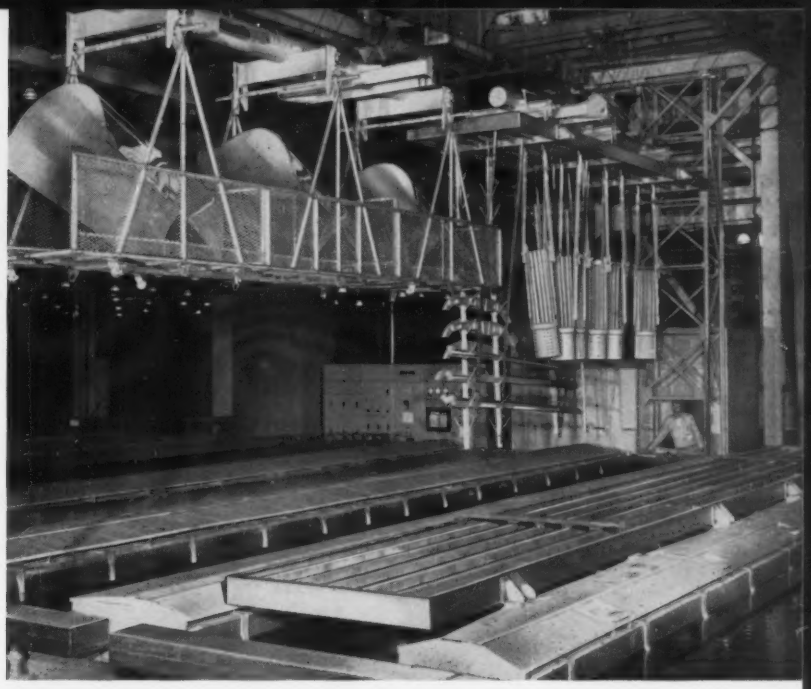


Fig. 8. General view of the anodizing installation which consists of twelve tanks and a gas-fired drying oven. This equipment is used for large aircraft panels or smaller components.

pneumatic rams. In Fig. 7, a rack-load of work is seen partially immersed in the quench tank. Work-loads weighing up to 5000 pounds can be handled at one time.

Anodizing equipment for large aluminum sheets and plates comprises twelve tanks and a Surface Combustion drying-oven, general views of this equipment being shown in Figs. 8 and 9. The first two tanks perform precleaning operations with alkaline cleansers; the next two tanks are for hot-water rinsing; the fifth tank contains a deoxidizer chemical; the sixth, a spray rinse; and the seventh, a hot-water rinse for raising the temperature of the material. The eighth tank contains a solution of No. 14 Iridite; the ninth tank, a hot-water rinse; the tenth tank, an anodic solution; the eleventh tank, a cold rinse; and the twelfth tank, a sealing solution. The oven is located adjacent to the twelfth tank. This oven uses enough natural gas to provide 2,600,000 Btu per hour.

Two men operate the entire system by push-buttons from either one or both cabs of overhead cranes that handle the work. All fumes

Fig. 9. Transferring a large aluminum sheet from one of the tanks in the anodizing installation into another tank.

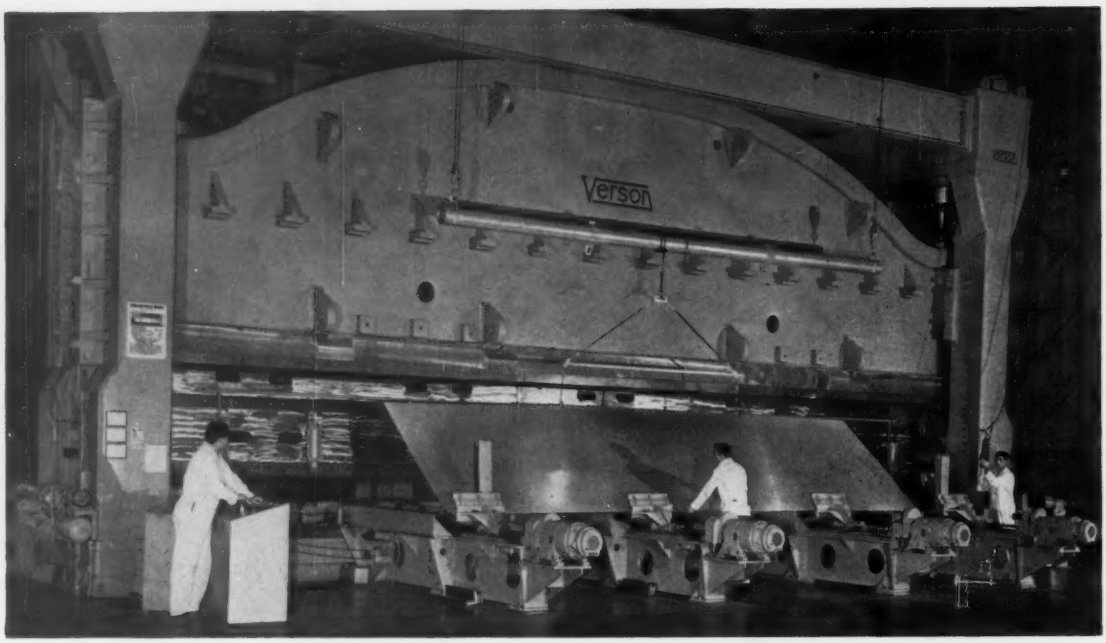


Fig. 10. Giant press brake which has a capacity for bending aluminum plates as thick as 3/4 inch and 40 feet long to a right angle.

Fig. 11. An electric eye and tape on the side of each table unit control the feeding of plates beneath the ram of the press brake.

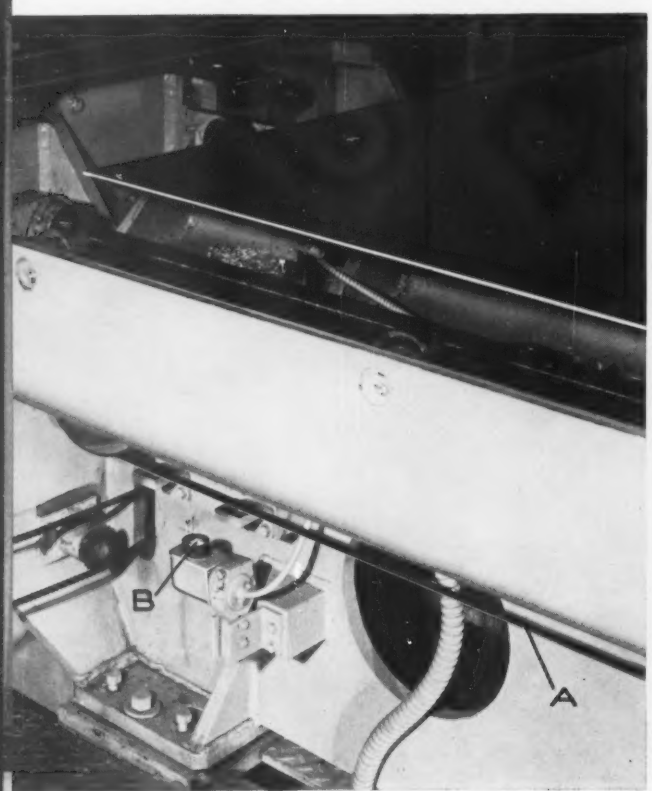
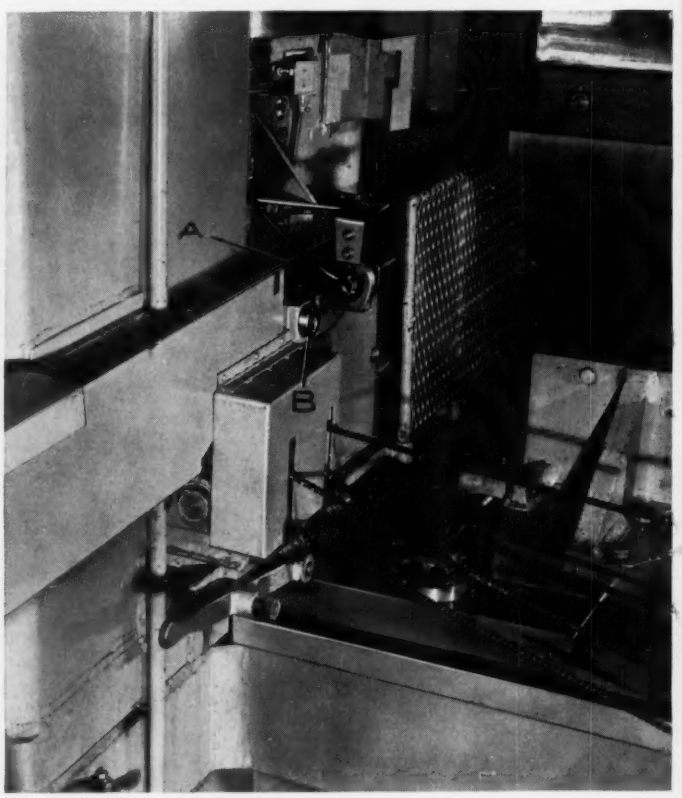


Fig. 12. An electric eye that operates in conjunction with a template controls the downward movement of the press brake ram.



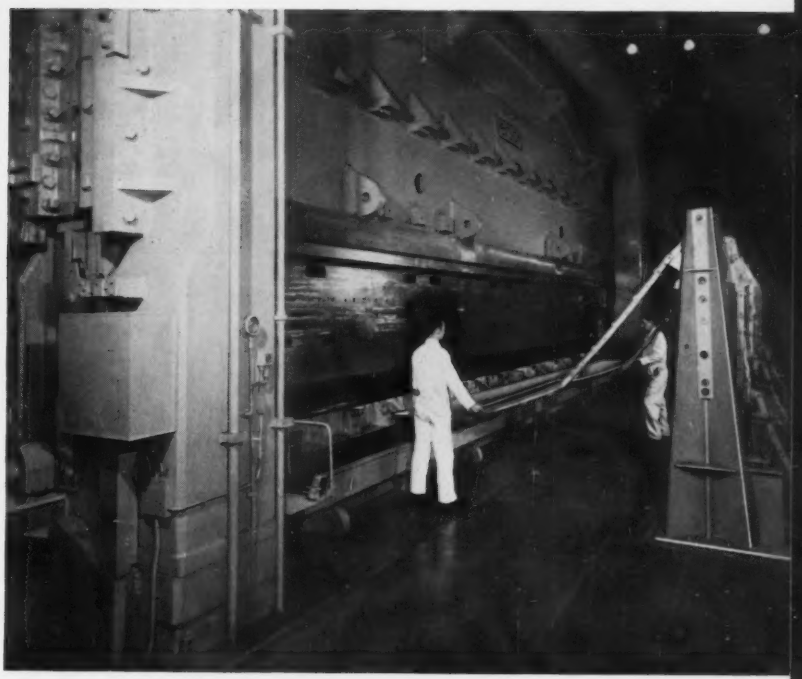


Fig. 13. Micarta-covered chains of special design at the rear of the press adjust automatically to the shape of the work-pieces and support them so as to eliminate spring-back

rising from the anodizing equipment are circulated through contaminate separators so as to eliminate smog.

The Verson press brake (seen in Fig. 10) has a capacity of 1800 tons which will enable it to make a right-angle bend in 3/4-inch aluminum plate 40 feet in length. The brake is used not only for forming flat plates and sheets but also for integrally ribbed plates. For such an operation, use is made of tooling that is provided with grooves to accommodate the ribs.

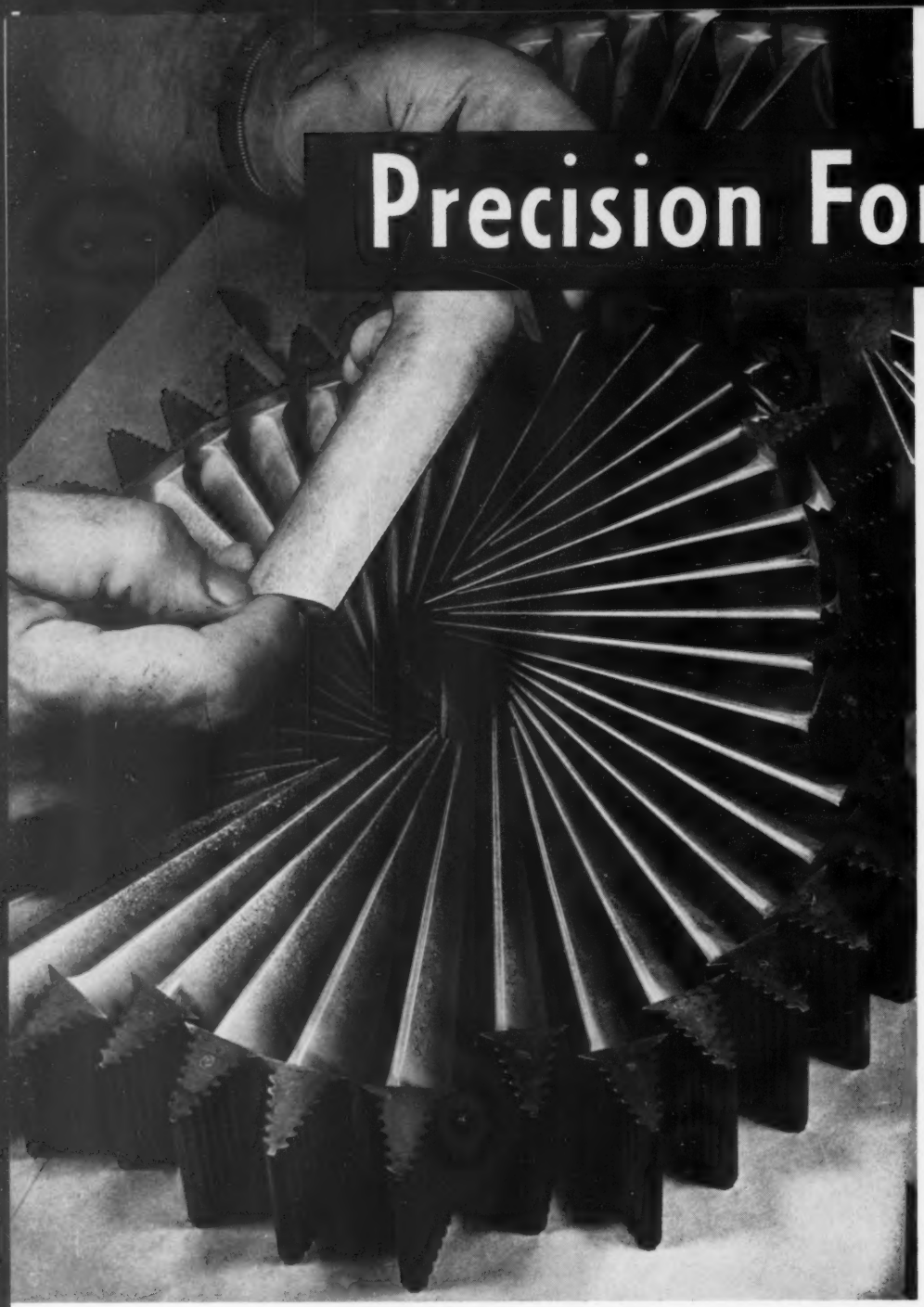
In operation, the plate to be formed is placed on a feed-table at the front of the brake. This table has four sections: two inside sections are used in unison to feed short plates under the brake ram, while the two outside sections are employed in combination with the inside sections for handling large plates. A notched band or tape made of Elgiloy, a steel alloy that is inert to temperature changes, is mounted on one side of the table sections to control the feeding movement of each section as the tape passes across a photoelectric cell. In this way a motor is energized and stopped. One tape may be seen at *A*, Fig. 11, and the corresponding photoelectric cell at *B*. The table sections are actuated by means of leadscrews to carry the plate under the ram to a predetermined point.

Eight equidistantly spaced pneumatic holddown jacks on the ram are equipped with rollers that contact the plate as the ram approaches the work and hold the plate securely while the forming portion of the stroke is completed. The brake ram then automatically levels itself in preparation for completing the bending stroke. All movements of the press ram are hydraulically actuated and are also controlled by templates and photoelectric cells. The end of one template can be seen at *A*, Fig. 12, and a photoelectric cell at *B*. The movement of the feed-table sections may be controlled individually so that the feed of one end of a long plate into the brake can be retarded. This arrangement makes it possible to form a taper in a part.

With complete coordination between the movement of the feed-table sections and the hydraulically actuated ram, progressive "hits" can be made on a plate in increments as small as 1 inch. The shape of the segmental ram die employed is designed to blend the contour of the work through progressive hits in such a way that the final contour is not angular but rather a true arc.

Plates 1 inch in thickness represent considerable weight and if such a plate were left unsupported at the rear of the press brake, a springback effect would be produced in the work. To counteract this tendency, a number of Micarta-covered roller chains have been provided at the back of the brake, as seen in Fig. 13, to receive the plate as it comes through the forming dies. These chains adjust themselves automatically to nest the plate in accordance with its changing contour while the operation is in progress. Overhead cranes are used to load the brake-table and to unload parts from the chain supports into portable handling fixtures.

Precision Forging



Vacuum melting of heat-resistant alloys, electrical resistance upsetting of billets, induction and high-speed gas heating, and impacting are some of the latest developments employed in the production of compressor blades and turbine buckets for jet engines used in the latest type aircraft

By EDWARD B. WELLS
Utica Drop Forge & Tool Corporation
Utica, N. Y.

# of Jet-Engine Blades

COMPLEXITY of shape, exacting tolerances specified, and resistance of the materials to forming and machining are the principal reasons why the production of blades is a major problem in jet-engine manufacturing. Various methods—including forging, casting, machining from the solid, powdered metallurgy, and fabrication—are constantly being tried by different companies to determine the best way of producing quality blades at high production rates and low cost.

At the Utica Drop Forge & Tool Corporation, precision forging is being used extensively to make many different jet-engine blades, varying from about 2 to 12 inches in length. Precision forging, as the name implies, differs from conventional practice in that the blades are forged to precision tolerances—in some cases, as little as 0.005 inch on specified blade thickness; plus or minus 1/4 degree on warp angle or twist; 0.004 inch on deflection in the over-all length of the blade; and plus or minus 0.003 inch in variation from the required contour. In this way, waste of expensive material from which the blades are made is reduced, and the amount of subsequent machining required is held to a minimum.

Compressor blades, which operate in the relatively cooler section of the jet engine (at temperatures up to about 700 degrees F.), pose no particular forging problem, as they are made from aluminum alloys or AISI type 400 series stainless steel. However, these blades must be metallurgically sound to resist fatigue from vibration or the impact of solid foreign matter, such as ice.

Turbine buckets, which must withstand temperatures of 1600 degrees F. or more and centrifugal forces of approximately 25,000 pounds per square inch, must be made from tougher, higher-strength, more heat-resistant alloys. Some of the alloys used for jet-engine turbine buckets are: International Nickel Co. high nickel-content materials such as Inconel X and Nimonic 80A, 90, and 95; Haynes Stellite cast alloys such as No. 21, N-153, N-155, and Hastelloy B; Allegheny-Ludlum 20 per cent nickel, 20 per cent chromium, and 38 per cent cobalt material S-816; Pratt & Whitney Aircraft Waspaloy; Timken 16 per cent chromium, 25 per cent nickel, and 6 per cent molybdenum alloy; and titanium alloys.

New alloys are continually being developed to better withstand the heat, centrifugal forces, thermal stresses, corrosion, and vibration to which they are subjected in the latest jet aircraft engines. Because the materials are designed to resist deformation, even at high temperatures, they are difficult to forge and machine. Complexity of the airfoil cross-section and root shape also make production of the blades more difficult. Some blades have exceptionally thin airfoil cross-sections and thick roots, which introduce the danger of cracking during heating and forging.

An unusual feature of the blade manufacturing facilities at Utica Drop Forge & Tool Corporation is that vacuum furnaces have been provided for melting a substantial portion of the heat-resistant alloys used. A major advantage of vacuum melting is that the excess material trimmed from forgings, hot tops from ingots, and miscellaneous scrap metal are used to charge the furnaces, and yet, the alloys obtained have extremely high purity, fine grain structure, and good forgeability. Pratt & Whitney Aircraft has conducted exhaustive tests to show that the stress-rupture life of Waspaloy blades has been boosted from approximately forty hours at a temperature of 1500 degrees F. with conventional electric arc-melted material, to a minimum well over seventy-five hours with vacuum-melted alloy.

Five vacuum furnaces are available: a 10-pound capacity experimental furnace made by the company; a 100-pound and a 300-pound furnace made by Consolidated Vacuum; and two F. J. Stokes 1000-pound units. A Tocco 300-K. W. induction-heating unit is provided for each of the larger furnaces, and an Ajax 100-K.W. unit for the smaller furnaces. The 300-pound, water-cooled furnace, which is shown in Fig. 1, completes a cycle every two hours. Twenty-three 10-pound ingots are cast per melt. The ingot molds are mounted on a rotary tray and placed in the furnace. After charging the crucible with scrap, the furnace is covered, air is evacuated, and electrical power is applied.

Close control is maintained of the melt analysis and temperature, with small additions being made to the charge as required. The temperature will vary with the material being melted; for example, Waspaloy is melted at about 2600 degrees F. At the completion of the proper time,

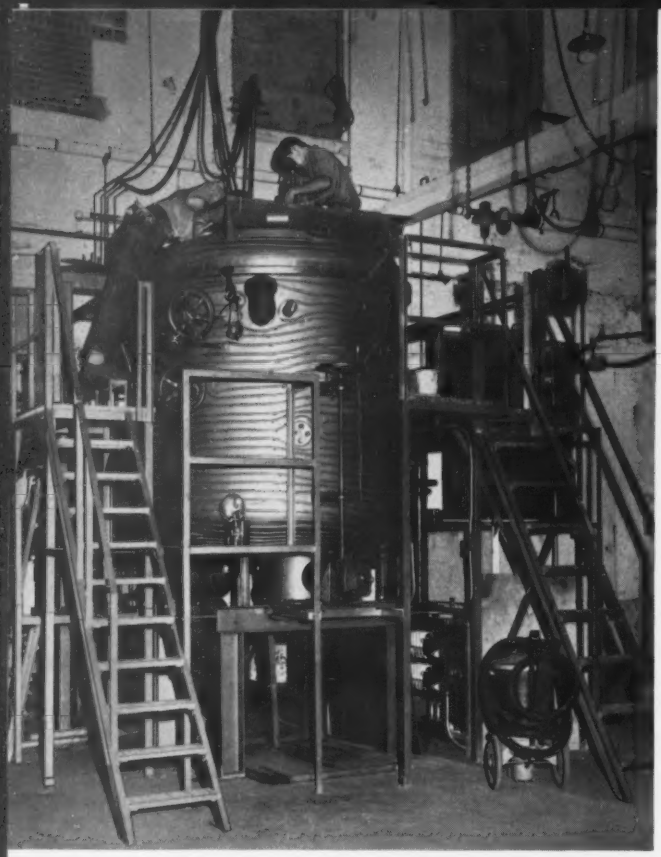


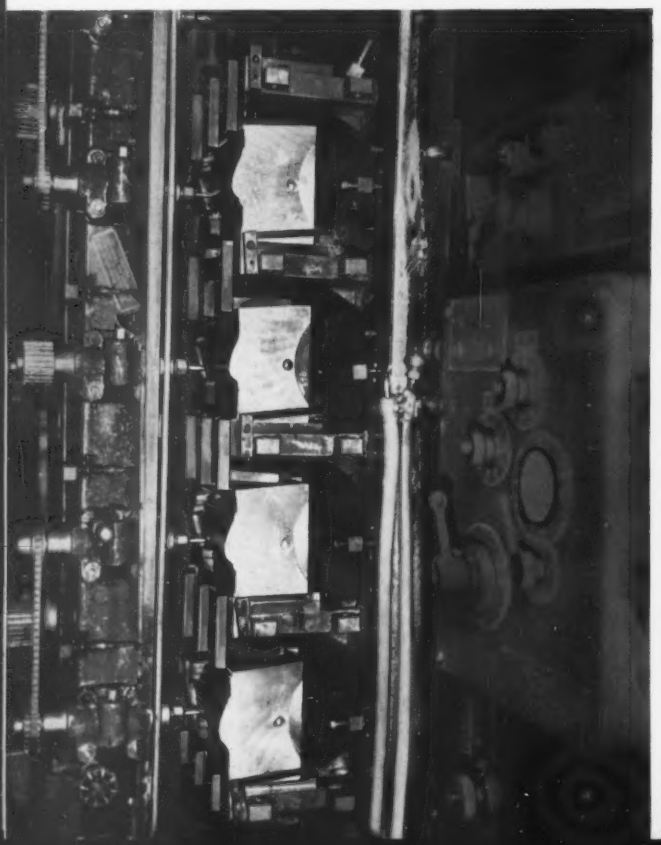
Fig. 1. Water-cooled vacuum furnace, heated by 100-K.W. induction unit, provides 300 pounds of high-purity alloy per heat from scrap charge.

the melt is manually poured into the ingots within the furnace. The hot tops are cropped, and the ingots are forged into bars. These bars are centerless ground, and cut into slugs of the exact length required for each blade.

The 1000-pound furnaces, which cycle every three hours, are believed to be the only ones in existence having centrifugal casting facilities. The furnaces are moved on rails to the casting devices, which have molds weighing 6000 pounds that rotate at from 200 to 400 R.P.M. Ring-shaped ingots weighing from 500 to 1000 pounds are centrifugally cast in the spinning molds. These rings are cut into quarter-sections and rolled, or cut into slugs for forging.

Precision forging dies are made from standard hot-work die-block material of the 5 per cent chromium, 1.5 per cent molybdenum, 1.25 per cent tungsten type. The die-blocks are heat-treated to obtain maximum properties. Rough-milling of the die-blocks is done on Pratt & Whitney multiple-spindle, copy-milling machines, such as the one seen in Fig. 2, and Keller tracer-controlled milling machines. The machine illustrated has two tracing units, one at the top and the other at the bottom, with the tracing spindles held in contact with the masters hydraulically.

Fig. 2. Multiple-spindle copy-milling machine for roughing the precision forging die-blocks made from chromium-molybdenum-tungsten alloy.



Masters for machining the precision forging dies are made to exacting tolerances by comparing the templates used in their manufacture with enlarged lay-outs on Jones & Lamson optical comparators. Smooth surface finishes are imparted to the die surfaces by grinding and polishing with portable tools. The smoothness of dies varies with the material to be forged—a surface finish of 10 micro-inches r.m.s. or less being specified for dies used to precision-forge aluminum alloys.

The life of blade-forging dies is relatively short because of the rapid wear caused by the thinness of the blades and high pressures required to form the heat-resistant alloys. Also, precision forging dies have a much shorter life than those used for rough forging of blades because of the closer tolerances that are maintained. Thick die-blocks are used at Utica, and they are resunk before discarding. In resinking, the die impressions are first removed by milling and grinding to produce a flat surface after annealing. Precision forging dies are sometimes salvaged by building up the impressions with hard-facing materials or by chromium-plating. However, such surfaces are usually too hard and subject to cracking under the high impact pressures employed in forging.

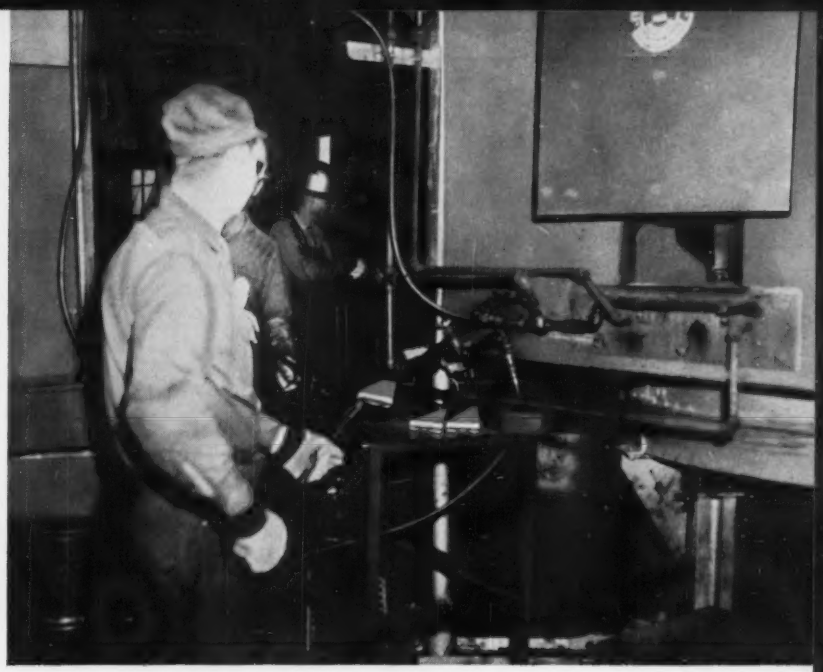


Fig. 3. Controlled-atmosphere, rotary-hearth electric furnace for bringing jet-engine blades to the forging temperature.

Controlled-atmosphere electric furnaces, high-speed direct gas-heating units, and induction heaters are employed to bring the blade billets to the required temperature for forging. The selection of the particular heating method to be used for each operation depends on the material to be forged, the production rate desired, the quantity of identical blades to be made, and whether all, or only a portion, of the billet is to be heated.

All three heating methods give relative freedom from scaling, decarburization, and distortion. The atmosphere used in rotary-hearth electric furnaces (Fig. 3) to keep scaling of the billets at a minimum will depend on the material being heated. A slightly reducing atmosphere is employed when the alloy is subject to intergranular corrosion, and an oxidizing atmosphere to prevent carburization. Recording pyrometers are used to accurately control the temperatures to which the billets are heated.

Rapid heating of billets or partially forged blades that are produced in large quantities is done with Selas high-speed, direct gas-heating furnaces, such as the ones shown in Fig. 4. Here, one operator is placing upset bars into rotary work-holders that carry them through the two furnaces. A compressed mixture of gas and air burns rapidly in the confined spaces of ceramic combustion chambers, and the heat of combustion is transferred directly to the bars as they are carried past the chambers. For rapid heating, the parts are exposed to a much higher temperature than that to which they are to be heated. Heated bars are removed from the rear of the

Fig. 4. One operator attends two high-speed, direct gas-heating furnaces, placing the upset bars into rotary work-holders which pass through the furnaces.

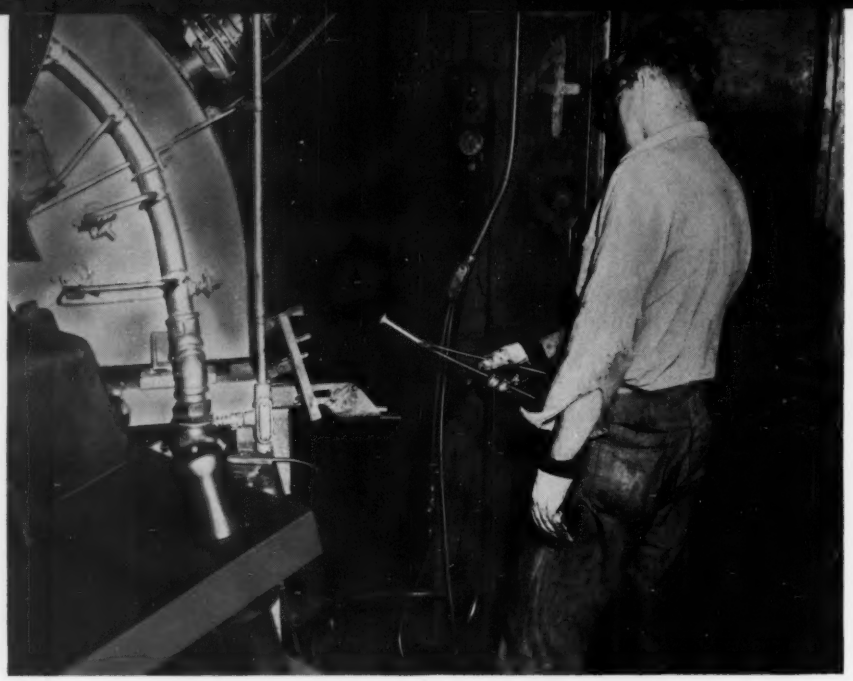


Fig. 5. Forging press operator removes the heated bars from rotary work-holder at rear of one of the high-speed gas furnaces seen in Fig. 4.

furnace, seen in Fig. 5, as required by the forging operator.

For very rapid heating of symmetrical billets, and where only a portion of the billet is to be selectively treated, electric induction units are used. With these units, heat is generated in the billets by their resistance to the flow of electrical current induced by a high-frequency current passing through water-cooled copper-tubing coils surrounding the billets. A Tocco induction set-up having four heating coils for one forging operation is seen in Fig. 6.

In the initial forging operation of hot upsetting or fullering, sufficient stock is gathered at one end of the billet for subsequent forming of the root portion of the blade. Upsetting is done on conventional vertical presses or horizontal upsetting machines, first heating the bars to a temperature of approximately 2100 degrees F. with induction units. A relatively new and rapid method of upsetting being widely used at Utica Drop Forge employs Omes electrical resistance upsetting machines. With this method, a portion of the bar having a length up to forty times the bar diameter can be upset—compared with a conventional maximum upset of three diameters.

On the Omes upsetter, Fig. 7, the centerless ground, cut-to-length bar is loosely gripped between a fixed lower electrode jaw and an upper hydraulically operated jaw. A ram, seen at the right, moves to the left, pushing against one end of the bar and pressing it against an anvil, seen at the left. Simultaneously, an electrical current is passed from the anvil, through the bar, and to

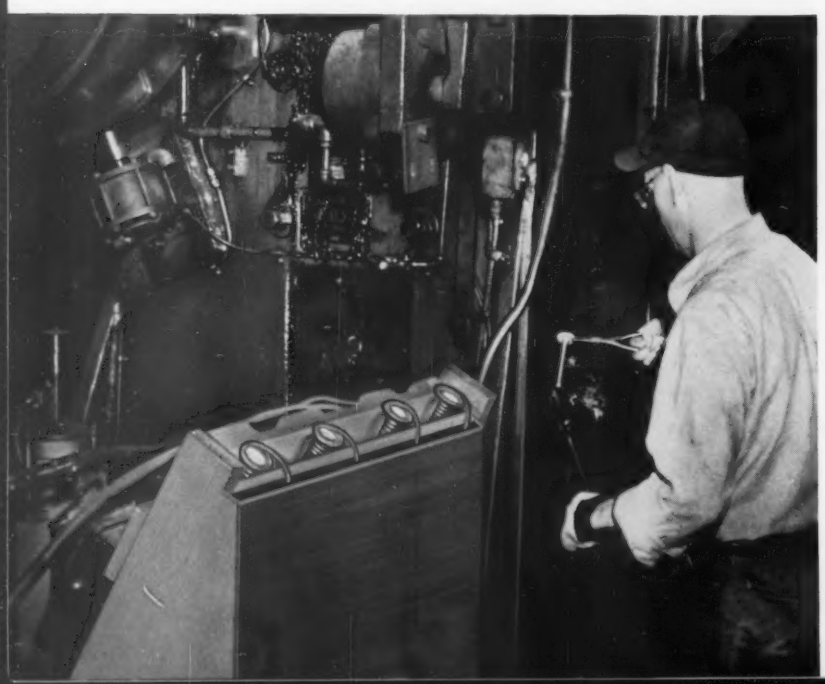


Fig. 6. Induction heating units such as this one are used for rapidly heating symmetrical billets, or selectively heating only a portion of the billets.

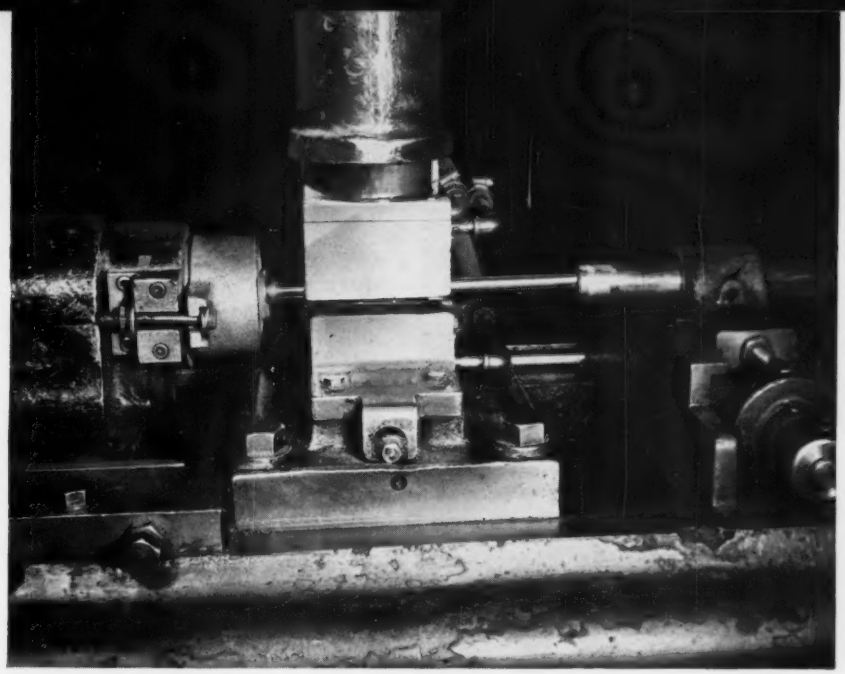


Fig. 7. Bar to be heated is gripped by jaws, and pushed by a ram (right) against anvil (left) while electrical current is passed from anvil to one jaw.

the electrode jaw. The resistance to current flow offered by that portion of the bar between the jaws and anvil causes it to become white hot in a few seconds. As the ram continues to advance, and the anvil retracts at a slower, controlled rate, a head of the required shape and size is formed on one end of the bar.

A starting bar, and one that has been upset, are shown in the operator's hands in Fig. 8. Advantage is taken of the heat generated in the bar during upsetting, by transferring it directly to a forging press for forming the blade root. In one application of the Omes upsetter, an SAE 4130 steel bar, 3/4 inch in diameter and 21 1/2 inches long, is upset to a length of 11 1/2 inches—almost half the total length of the bar and approximately 15 1/3 diameters. Over-all blade production time has been reduced as much as 50 per cent, and material savings up to 20 per cent have resulted from the use of these upsetters.

Actual forging of the jet-engine blades is done either on mechanical presses or on gravity board hammers. Presses ranging in size up to Bliss or Clearing 1600-ton capacity are used, such as the one seen in Fig. 9. The drop-hammers are of the board or air lift type. These range in size up to the Erie 5000-ton hammer shown in Fig. 10. An interesting solution to the problem of installing the huge 1600-ton press weighing 200,000 pounds was to fill the pit for the press base with ice, the press settling slowly into position as the ice melted.

The selection of a particular press, as well as the number of forging operations required, de-

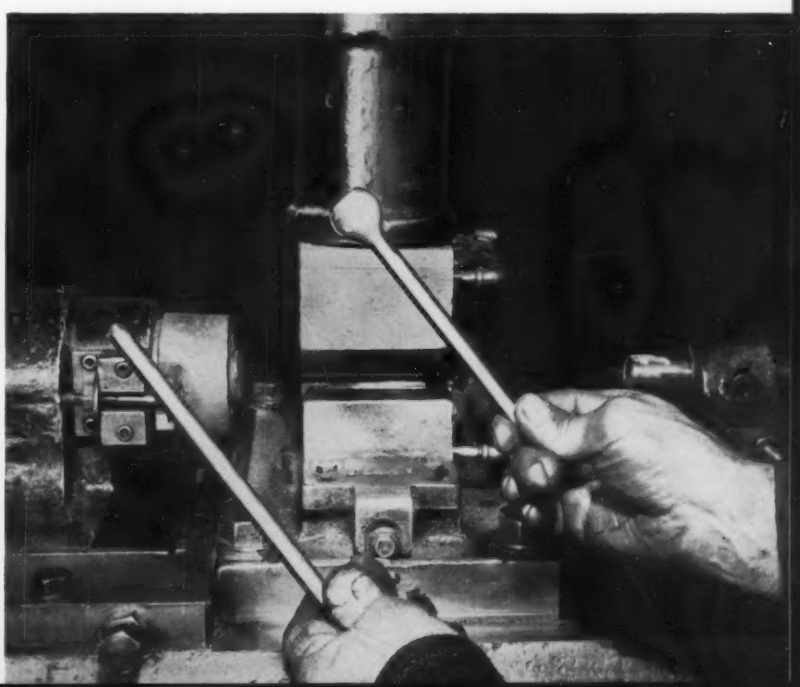


Fig. 8. Centerless-ground, cut-to-length bar in operator's left hand is upset to form head on one end of bar by means of machine seen in Fig. 7.

Fig. 9. This 1600-ton mechanical forging press is the largest one employed in producing jet-engine blades from various heat- and corrosion-resistant materials.

pends on the material to be forged, the surface area of the blade, and the tolerances that must be maintained. In general, initial forging operations on all types of materials are done on the mechanical presses, and final forging on the drop-hammers. However, aluminum-alloy compressor blades are completely forged on mechanical presses.

For example, in making the stainless-steel first-stage compressor blades for the Pratt & Whitney J-57 jet engine, the upset bars are flattened or blocked to rough shape on a 1000-ton mechanical press. After cleaning and descaling, the partially completed blades are heated to 1900 degrees F. in controlled-atmosphere, rotary electric furnaces, and then finish-forged in the Bliss 1600-ton forging press. Only one blow is delivered in finish-forging. While the blade is still hot, excess material forced into the gutters surrounding the die impressions in the form of flash is trimmed off in a Bliss inclinable press.

Also, in forging titanium-alloy blades, an attempt is made to obtain maximum deformation with one stroke of the press because of the work-hardening properties of the material. Shapes successively formed in precision forging AMS 5616 steel blades are shown in Fig. 11, with the 3/4-inch diameter by 12 7/8-inch long bar seen at the left. Operations performed in sequence on this compressor blade are upsetting, breakdown, finish-forging, trimming, and coining.

Frequent visual inspections of the forgings are made to detect cracks, seams, folds, or other surface defects. To permit inspection, the forgings

Fig. 10. Finish-forging of many of the turbine and compressor blades is performed on this 5000-pound and a number of smaller size drop-hammers.

Fig. 11. Successive shapes produced in precision forging a compressor blade, seen at right, from cut-to-length, centerless-ground bar shown at left.

are cleaned by blasting, acid-pickling, or by reverse-plating or etching. Even the slightest surface defects are removed by grinding before further forging, to prevent the defects from being pounded deeper into the blades. Jones & Lamson optical comparators are also used for occasional spot checks to insure that the required contour is being forged on the blades.

One of the latest developments in forging techniques is impacting. Impacting is forging performed in mid-air on a Chambersburg Impacter hammer equipped with two opposing impellers that carry the dies for forming the billet. The reciprocating impellers are driven together in a horizontal plane by compressed air with the billet suspended between the two dies. Since the material is worked equally from opposing sides, uniformity is insured, and less energy is required as the metal has to travel shorter distances. Also, the heated material contacts the dies a shorter time, and shock and vibration are eliminated.

Two Impacters have been combined with automatic work-handling devices and high-speed gas-heating units for one Chambersburg Cecomatic forging installation. Automatic feeding devices carry the blade billets from two hoppers, Fig. 12, to Selas high-speed, direct gas-heating furnaces. To facilitate handling, a carbon-steel sprue is welded to the previously upset billet before heating for impacting. Heated billets are carried by chutes to a transfer device that loads the Cecomatic conveyor.

Rough-forging is done on the first Impacter, and the blades are finish-forged on the second machine. A cut-off attachment separates the sprue from the finished blade at the completion of the automatic cycle.

As a final step prior to machining, the forged blades are subjected to either a Magnaflux or Zyglo inspection, depending upon whether the material from which the blades are made is magnetic or non-magnetic.

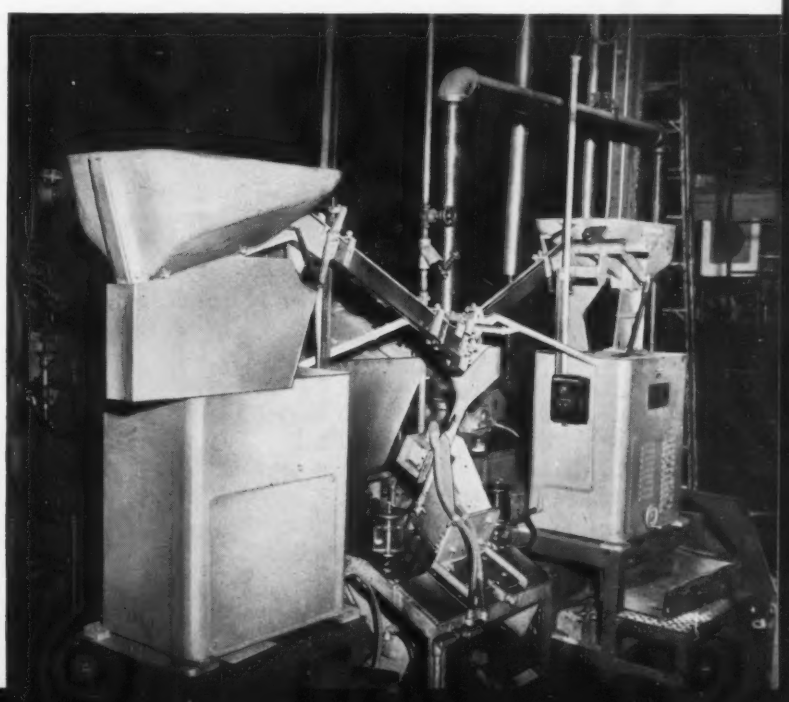


Fig. 12. At loading end of Cecomatic forging installation, blade billets are automatically fed from two hoppers to high-speed, direct gas-heating furnaces.

Convair

By FRED MONAHAN

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WHEREVER critically stressed parts are used in aircraft construction, high-quality welding becomes of paramount importance. Close control of methods is essential to strong welded assemblies. For this reason, Convair developed a welding procedure that covers the engineering of steel weldments, the planning of welding operations, the design of tooling, material procurement and inspection, heat-treatment, and other phases of the process.

Arc-welding chromium-molybdenum steel and heat-treating the weldments to develop an ultimate tensile strength of 160,000 to 180,000 pounds per square inch are covered by the procedure which will be outlined in this article. Not all steel weldments are critically stressed, however, and in such instances it is possible to relax somewhat on the degree of control exercised over welding operations. It must be borne in mind that whenever the control is relaxed, maximum quality of welds is unlikely.

In designing weldments, manufacturing limitations must be considered, and it should be recognized that welding is not a precision operation. Therefore, parts should not be designed as weldments if close dimensional tolerances are necessary and if those tolerances cannot be obtained by subsequent machining operations. The normal tolerance obtainable on a weld detail at a reasonable cost is plus or minus 0.030 inch. Customary practice in determining accuracy of a part is to add together this tolerance for each detail and then add another tolerance of 0.030 inch for the assembly.

Uniform plate thickness throughout a part is desirable, but is not usually essential. Generally speaking, a weld penetration of 100 per cent is specified. On thick plates this requires chamfering of the edges. Both sides of a plate are welded wherever possible in order to balance stresses, to close up pockets or cracks in which cleaning or plating solution may be trapped, to eliminate

Procedure in Quality Welding

stress concentration, and to avoid misreading of X-ray pictures in which a welding crack may be mistaken for an unwelded edge. The practice followed is to zone the welds into areas of high and low stress, and to permit small gas pockets to be present in non-critical areas. Tool checking points are specified on all drawings.

Design drawings should allow as broad a tolerance on heat-treatment as possible. This is desirable because when thin and thick sections are present in the same part, the different sections do not cool at precisely the same rate and, therefore, the same hardness is not obtained. The hardness range is specified closely for critical areas, and a broader range is allowed for other areas.

All plates to be welded must be free from internal delaminations or flaws and are sonic tested to determine whether they are of high quality. The carbon content of plates is certified on whatever material is to be used for a critical service. The content must be on the high side of the range, or a plate of a higher carbon-alloy number should be specified. Steel plates of dissimilar carbon content can sometimes be used in the same weldment, particularly if the same hardness is necessary in thin and thick sections.

Specifications read that all plates must be in the annealed condition before welding. If a torch has been used to cut out the part details, they must be annealed. On such parts it is a frequent practice to leave 3/16 inch of stock all around the cut-off edges, and this stock is removed by machining after annealing.

Two plates 1/4 inch thick, welded across a full width of 12 inches, may shrink at the weld as much as 0.030 inch. Therefore, the engineer must adjust detail dimensions accordingly. Shrinking can be reduced somewhat by peening the welds before they cool, and also by preheating the details to as high a temperature as is practical with due regard to the metallurgy of the steel. Preheating SAE 4130 steel to 400 degrees F., and SAE 4140 and 4340 steels to 600 degrees F. is desirable. All sub-assemblies and final assemblies are stress relieved at 1200 degrees F. This heat-treatment is performed in a controlled atmosphere, so as to prevent decarburization by oxygen. One of the furnaces used for preheating and post-heating of weldments is seen in Fig. 1.

Preliminary planning of welding operations is carried out by representatives of various departments concerned and the final planning is approved by the supervisory force of engineering, planning, tooling, inspection and welding departments. Detail planning cards are also prepared.

In the planning, the following procedure is observed: (a) The weldment is broken down into sub-assemblies consisting of simple geometric shapes that will require the minimum amount of welding at final assembly. (b) Sub-assemblies are broken down into smaller sub-assemblies

Fig. 1. Type of furnace employed for preheating and post-heating steel weldments.

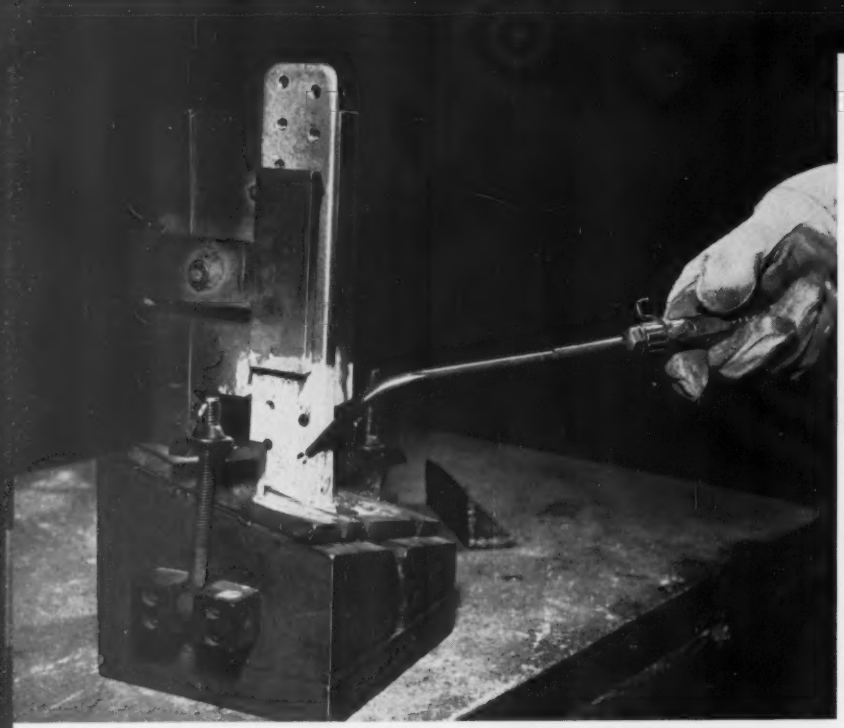


Fig. 2. Oxy-acetylene torch is sometimes applied to maintain preheated temperatures while weldment details are being set up in a jig preparatory to a welding operation.

on the basis of the accessibility of welds and symmetrical balancing of welds. It should be kept in mind that difficult welds, or those liable to cause distortion or other difficulties should be made in the earliest possible sub-assemblies so that any errors can be corrected or the parts scrapped. (c) Separate fixtures are used for tack-welding and subsequent solid-welding operations because the accuracy of tack-welding fixtures could easily be affected by preheating, weld splash, or heat distortion. The solid-welding fixtures are provided with electric heaters and the preheat temperature is maintained throughout the heating cycle.

An oven is employed to bring the parts up to the preheat temperature before they are placed in the welding fixture. Occasionally, heat is applied by gas torches after the details have been placed in the fixtures. A typical application of a torch for this purpose is seen in Fig. 2. Asbestos blankets are used to cover parts and the fixture in the areas where welding is not being actually performed. Plates 3/8 inch and thicker are preheated to at least 100 degrees F. before cutting with an oxy-acetylene torch.

All sub-assemblies must have a metal-to-metal contact in the assembling operation to insure high-strength weldments. The custom is to make solid welds up to tack welds and then grind away the tack weld before welding that portion of a sub-assembly. In welding, an anti-splatter compound is frequently provided on the work and fixture in the welding area, as seen in Fig. 3. Immediately after solid welding, sub-assemblies are

Fig. 3. Anti-splatter compound is provided around work-piece and fixture in welding operations on assemblies and sub-assemblies.

Fig. 4. Typical hinged welding fixture which holds several pieces securely and at the same time permits easy access to all joints for performing the operation in the down-hand position.

placed in a furnace and heated to 600 degrees F. They are left in the oven long enough to insure a uniform temperature throughout, after which they are permitted to cool slowly to room temperature. All welds are ground smooth to facilitate Magnaflux inspection and to reduce stress risers. If it is necessary to start a weld where another ends, the previous weld is ground to a taper that is blended down to a feathered edge.

Weldments are magnetically inspected, and necessary repairs are made before the heat-treating operation is performed. Pin-holes, under-cuts, and overlays are ground out and faired in. Straightening is performed while the part is in the annealed condition. Magnetic inspection should again be performed as a safety check against cracks after any straightening.

Preparatory to the heat-treatment of weldments, carbon-steel plates are sometimes attached to thin sections, such as webs, to slow up the quenching of these areas and equalize the hardening time with that required for the thicker sections. A heat-transferring paste is applied between thin plates and the webs, so as to eliminate air pockets. A jig is sometimes used to maintain alignment of the weldment during heat-treating.

Arrangements are made to insure minimum delay in transferring a weldment from the furnace to the quenching tank. The latter is equipped with jets that force cool oil on the heavier sections in order to accelerate the operation. This helps to equalize the hardening process on the thick and thin sections and results in a more even hardness throughout the work-piece. Weldments are tempered before they cool lower than 400 degrees F. to relieve quench stresses.

In the final inspection, all parts are checked dimensionally and the Magnaflux process is used to inspect welds for cracks or pin-holes. Periodically, a part is X-rayed. If repairs are required that involve welding, the part is completely annealed before repairs are made. Hardness checks are conducted in all critical areas.

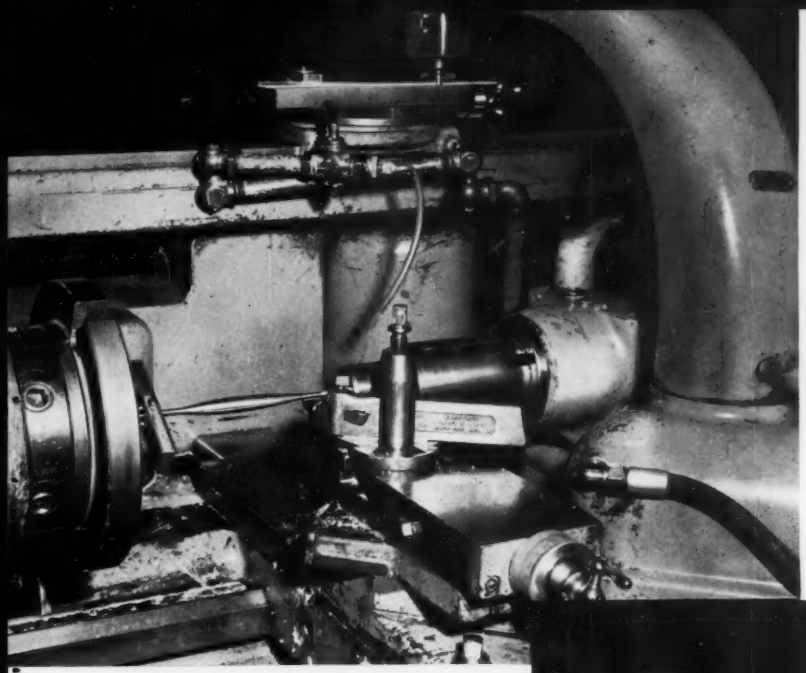
Fig. 5. The weld beads of all weldments are hand-ground prior to Magnaflux inspection to insure accurate readings.

Model Machine Shop Serves Boeing Wind Tunnel

THE largest privately owned wind tunnel in the nation for investigating the flying characteristics of aircraft is located at the Seattle, Wash., plant of the Boeing Airplane Co. Models of planes carefully made to a reduced scale can be subjected to wind speeds in the critical transonic flight range. These winds are produced by a two-stage fan which is 24 feet in diameter and driven by two motors having a total output of 54,000 H.P. Responses of the plane models to lift, drag, pitching moment, side force, and roll and yawing moment are recorded on instruments mounted on a control panel.

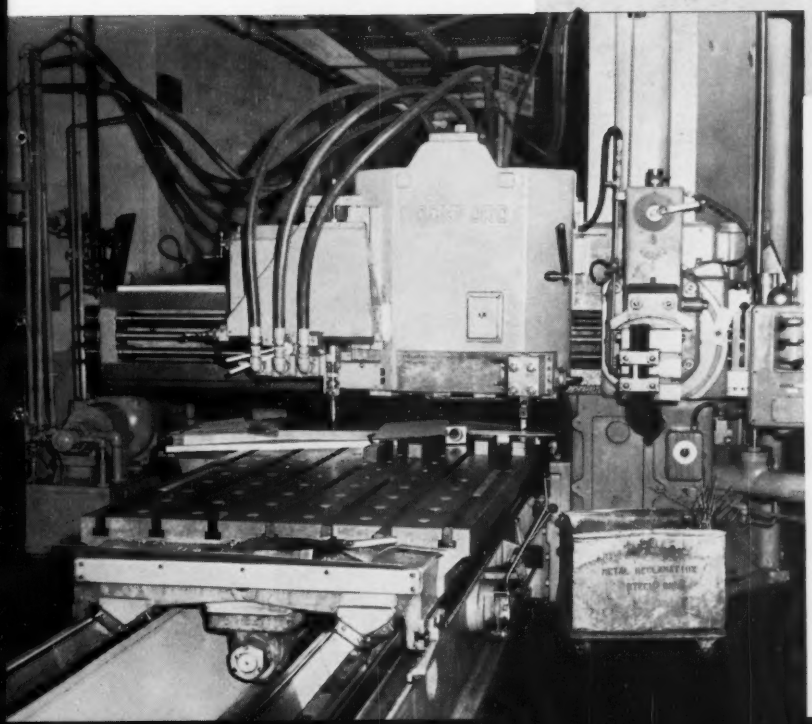
For high-speed test purposes, models with wing spans as great as 9 feet can be accommodated—a feature of importance, since the larger the model the more closely it duplicates the performance of the actual aircraft. These models are made in a shop located in the same building as the wind tunnel. The shop is adequately fitted with machine tools and woodworking equipment. The same shop also built most of the ingenious devices that check the models as flight conditions are simulated. Boeing, incidentally, will start erecting a second wind tunnel which will produce wind speeds in the supersonic range, as high as 4 Mach (approximately 2800 miles per hour).

A modelmaker machines two deep slots with a 1/8-inch endmill in a high-alloy steel part. The cutter is held in a Tree head mounted on a Brown & Sharpe No. 0 "Omniversal" milling machine.



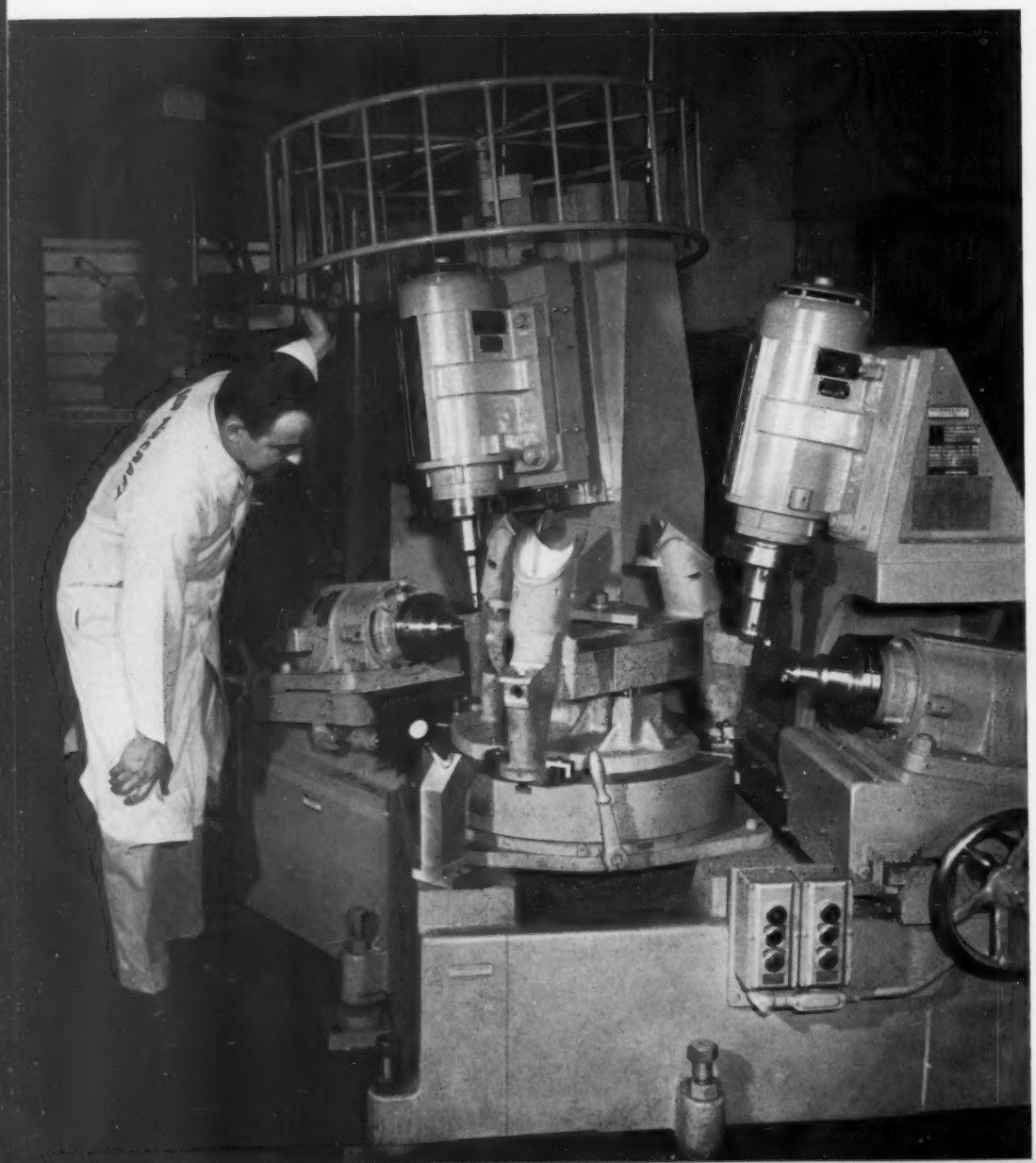
(Left) A tapered component, known as a body of revolution, is shown being turned on a Monarch 16-inch engine lathe. The air-hydraulic tracer attachment used assures accurate duplication.

(Right) Hand-polishing the openings in a wind-tunnel balance with a dentist's flexible shaft deburring tool.



(Left) Scale models of high-speed wings are duplicated on the Rockford hydraulic 48-inch by 10-foot open-side planer illustrated.

Northrop Missiles Made to Optical Accuracy



Specially designed machines and optical equipment are employed to maintain parallelism of milled surfaces to 0.0002 inch within a 10-inch span, angular location to 1 second of arc, and similar extremely close tolerances in producing parts for the Snark missile

AMERICA'S new "push-button" weapons, such as the Snark missile being developed by Northrop Aircraft, Inc., Hawthorne, Calif., require the production of parts to extremely close tolerances. For example, in some instances, angular locations must be held to the ultra-precise limits of 1 second of arc. This specification is 3600 times more precise than customary airframe tolerances of plus or minus 30 minutes.

To illustrate the effect of such precision, Northrop missile engineers cite the following example. A rocket or missile aimed at a spot on the earth's surface 5000 miles distant, and traveling at no greater deviation than 1 second of arc, would strike within 120 feet of its target. Similarly, the crater of Tycho on the moon (237,000 miles in outer space) would be hit within 1.13 miles of dead center.

Tooling experts at Northrop have developed a "precision quintet" of heavy-duty machines to obtain the required accuracy. The five machines have cast Meehanite bases with built-in strain gages, which were used when scraping and lapping the ways, and can be used for re-leveling. On one machine, several different surfaces can be milled in sequence and two or more compound angular surfaces milled at the same time. Also, parallelism of two surfaces can be held to 0.0002 inch within a 10-inch span.

One of the specially designed machines, for boring, counterboring, and chamfering location holes in a Snark missile casting, is seen in Fig. 1. This machine has a Pope direct-drive spindle, and a Cleveland indexing table equipped with a built-in 40-power microscope for precise settings of the work-piece and fixture, and for exact readings of the extremely fine table calibrations. Slow feeds, high speeds, and light cuts are used to obtain near-mirror surface finishes. On this machine, built to Northrop design specifications by the Special Tools & Machinery Co., Los Angeles, Calif., the spindle is fed in at only 0.008 inch per revolution of the hand-feed control wheel.

A specially designed boring-bar is a feature of the machine shown in Fig. 2, which was built by Mechanical Specialties Co., Los Angeles, Calif. This machine is also equipped with a Pope motorized spindle, built-in strain gages, and a Cleveland precision indexing table with a built-in

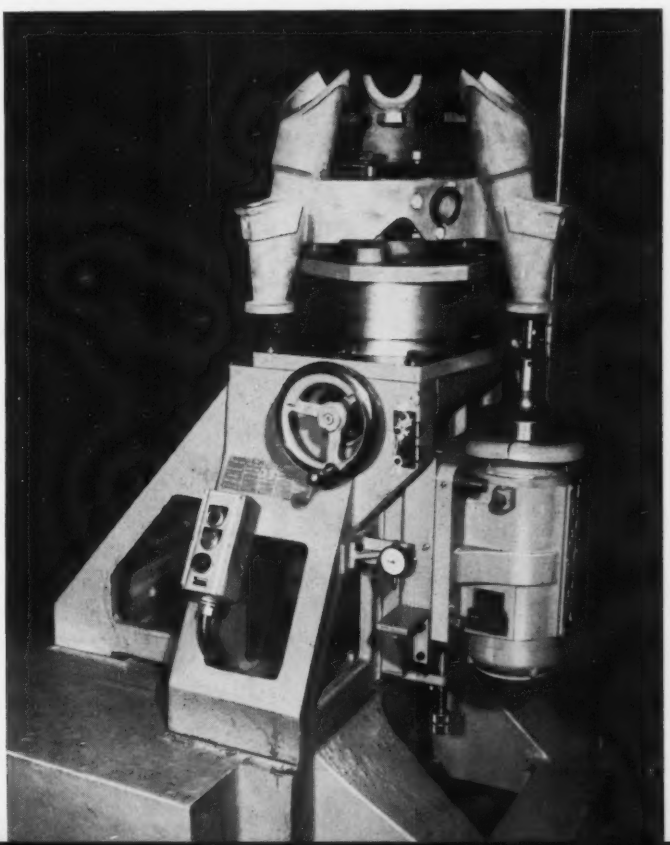


Fig. 1. Boring, counterboring, and chamfering of location holes in a Snark missile casting are performed on this specially designed machine.

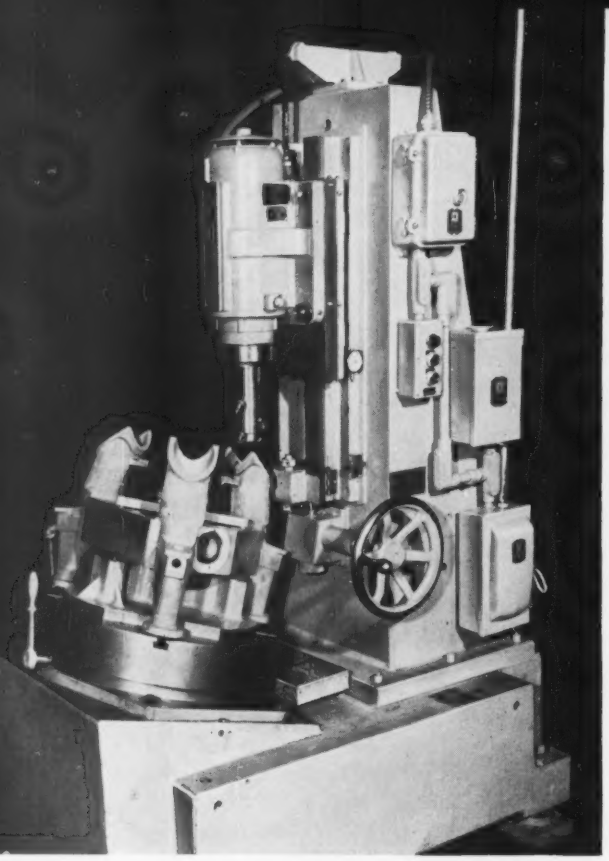


Fig. 2. Boring-bar on this machine carries four tools to produce a surface finish of 63 micro-inches r.m.s. and hold size within 0.0009 inch.

40-power microscope that permits three-location, 180-degree indexing within an angular tolerance of plus or minus 5 seconds. Four DeVlieg Microbore tools are utilized in sequence to produce a surface finish of 63 micro-inches r.m.s. on the bores, maintaining bore size within plus 0.0009 inch, minus 0.0000 inch. A hand feed advances the tools 0.025 inch per revolution of the control wheel.

Precision angular boring is accomplished on the machine seen in the heading illustration, which was built to Northrop design and specifications by the Falco Machine & Tool Co., Los Angeles, Calif. Four motorized heads perform boring, counterboring, and milling operations in sequence at different angles. The head at the extreme left is equipped with a solid carbide drill that is rotated at 3600 R.P.M. to produce a surface finish of 32 micro-inches r.m.s. Angular tolerances are held to plus or minus 1 minute of arc in machining, and as low as 1 second of arc in subsequent grinding and lapping.

Two compound angles are milled at the same time on another of the special machines, Fig. 3. The belt-driven spindles are equipped with DeVlieg cutter-heads. A console is employed to operate both the cutter-heads and the cross-feed. The set-up is accomplished with optical collimators and a Sheffield Precisionaire gage having Plunjet gaging cartridges, permitting an accuracy to 10 seconds of arc. This extremely accurate machine also was manufactured by the Special Tools & Machinery Co.

Fig. 3. Two compound angles are milled at same time in this set-up. Optical collimators and a Precisionaire gage permit an accuracy to 10 seconds of arc.

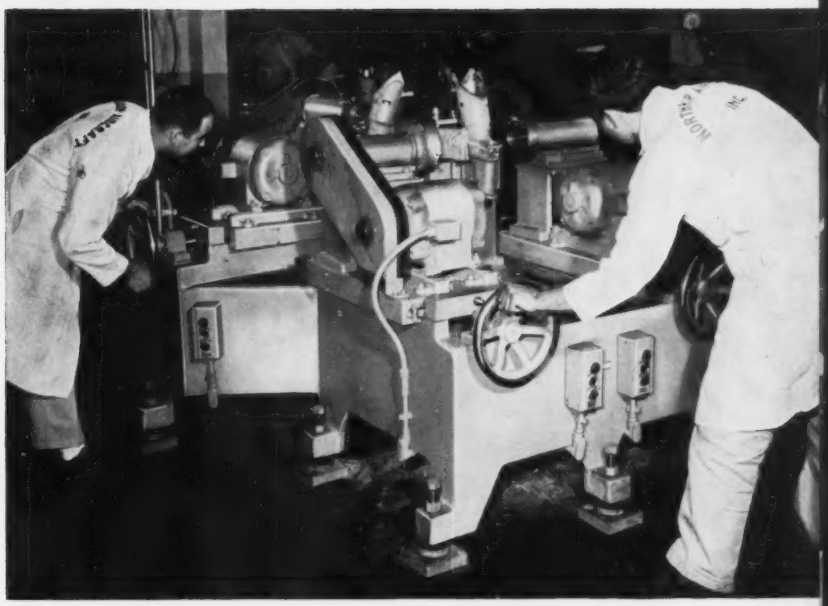


Fig. 4. Carriage ways on this specially developed precision milling machine have been ground, scraped, and lapped within 5 seconds of arc for squareness.

The fifth machine in the specially developed precision quintet is shown in Fig. 4. This machine, made to Northrop design by the Falco Machine & Tool Co., is used to mill, in sequence, two parallel surfaces and one surface 90 degrees from the other two. The belt-driven spindles are equipped with cutter-heads carrying carbide cutters. Carriage ways on the machine have been hardened, ground, scraped, and lapped within 5 seconds of arc for squareness.

So precise are the new machines, that Northrop also had to devise special checking fixtures and gages to adequately inspect the Snark missile components. Ordinary methods of inspecting work-pieces manufactured to such rigid specifications cannot be used, and it was necessary to employ optical inspection devices. For example, Fig. 5 illustrates a checking stand equipped with seven optical collimators for inspecting a missile part to tolerances as low as 1 second of arc.

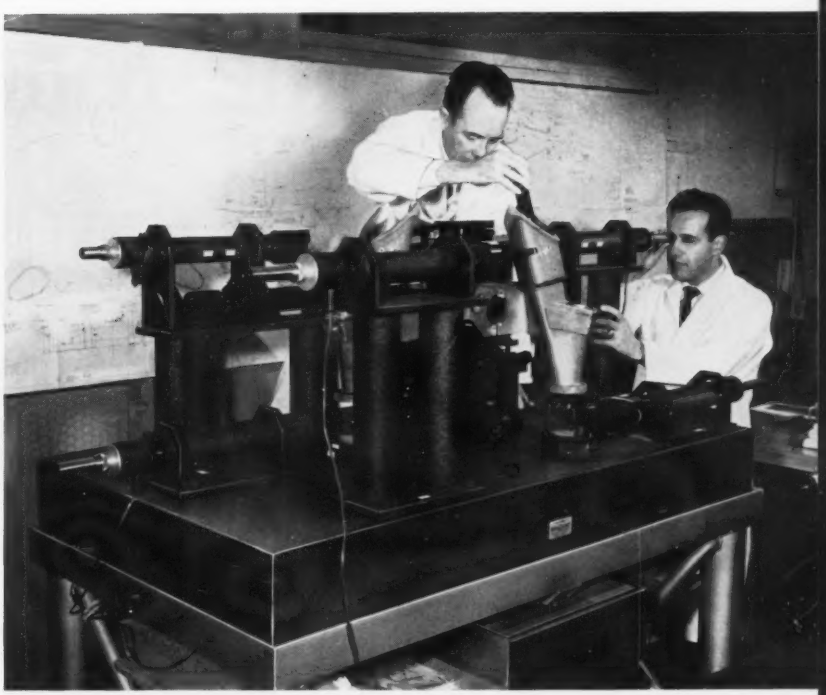


Fig. 5. This special checking stand for the inspection of machined Snark missile components to close tolerances is equipped with seven optical collimators.

Innovations in Jet-Engine Manufacture

New tools and methods are outstanding features of manufacturing operations at Orenda Engines Limited. Major improvements in the Orenda turbo-jet engine have brought about these innovations

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A MORE advanced, more powerful design turbo-jet aircraft engine is currently in quantity production at Orenda Engines Limited, Malton, Ontario, a member company of A. V. Roe Canada Limited, Canada's largest aeronautical organization. The engines are used to power the twin-jet CF-100, all-weather interceptor plane being built by Avro Aircraft, and Sabres being built by Canadair Limited, one of the latter being shown in heading illustration.

Redesign of many of the parts for the turbo-jet engine has necessitated the adoption of several innovations in machines, fixtures, and techniques employed in production. Some of the more outstanding new tools and methods used will be illustrated and described in this article.

Magnesium-alloy compressor-stator casings for the new Orenda turbo-jet engine are cast in

longitudinal halves to form an upper and lower housing. In previous designs of the engine, the ten rows (stages) of stationary vanes were mounted by dovetails in stator rings which were retained in place by lips on interstage spacers. The spacers were, in turn, bolted to the bore of the stator casing. In the new design engine, the stator rings are retained by internal T-slot grooves machined directly into the bore of the compressor casing, thus eliminating the need for stator spacer rings.

While simplifying the design, the new compressor-stator casing posed more complex machining problems. A cross-sectional drawing of a casing half, Fig. 1, shows some of the many dimensions that must be maintained within close tolerances during machining. Also, finishes on several of the surfaces must be held to 32 microinches r.m.s. These machining problems have been solved successfully by performing all the turning, facing, boring, contouring, grooving, slotting, and chamfering operations in two set-ups on Bullard Man-Au-Trol vertical turret lathes, such as the one seen in Fig. 2.

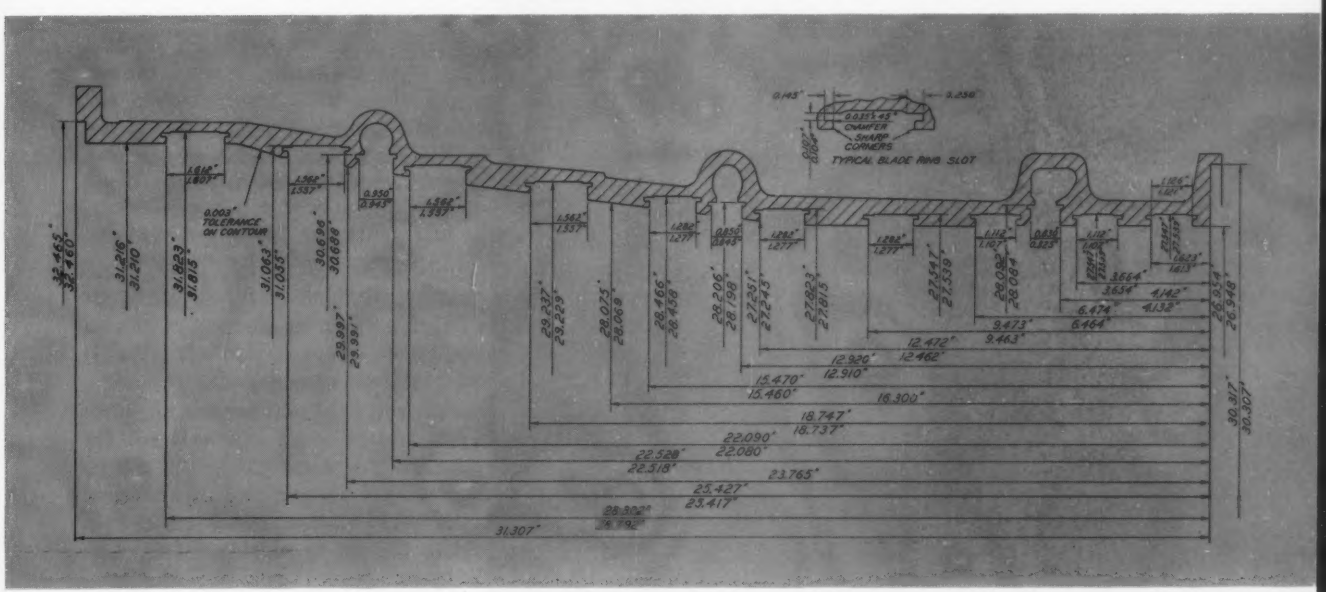
Roughing operations are performed on one vertical turret lathe, and finishing is completed on a second machine. The machines are equipped with both a left- and right-hand ram, each having a horizontal and vertical Man-Au-Trol unit that automatically control various movements. A hand-indexed turret at the lower end of each ram carries four carbide-tipped tools.

Prior to any machining operations, the compressor-stator casings (upper and lower halves) are qualified by Receiving Inspection. At this time, two dowel holes are drilled and reamed in the two flange faces of each half casing. Also, two locating holes are drilled and reamed in two of the six pads that are cast integrally with the upper half casing. Later these pads are cut off. For machining the compressor-stator casing halves, the flange faces are roughed and finished, and the bolt holes drilled. The casing halves are then temporarily assembled—locating from the dowel holes in the flange faces.

Assembled casings are mounted in special fixtures on the rotary tables of the machines, locating from holes reamed in the lugs and manually clamping on the lugs. To prevent distortion of the relatively thin walls of the casing during machining, jack-screw dampers are applied to the periphery of the casting for support. Six of the dampers are employed during rough machining, and eight for finishing.

In rough machining, the compressor-stator casings are rough contour-bored, both front and rear flanges are rough-faced, and all thirteen slots (ten for holding stator rings and three for air take-off passages) are rough-formed. The open design of the fixture permits both flanges to be faced in one chucking of the work, without the need for turning the work over and resetting it in the fixture. Also, in the same set-up, a right-angle hook tool is employed to turn a 2-inch length on the periphery of the casting for subsequent assembly of a slave ring.

Fig. 1. Cross-sectional drawing of half of a compressor-stator casing shows some of the close tolerances held during machining.



Approximately 1/4 inch of stock is removed from the various surfaces during rough machining, leaving 0.050 inch of stock in the bore and 0.030 inch on the faces for removal during finishing. The casing assembly is rotated at 108 R.P.M., providing a cutting speed of about 770 feet per minute, and the tools are fed at rates of 0.010 and 0.015 inch per revolution.

In finish machining the compressor casings, Fig. 3, the inner contour is finish-bored, the thirteen slots are finish-formed, and front and rear ends of the casing are counterbored. The T-slots for holding the stator rings are cut by T-shaped, carbide-tipped tools that are automatically fed in (to depth), up, down, then back to the center of the slot, and finally out. Repositioning of the tools and their feed paths are automatically controlled to cut each successive slot. An identical tool on both rams finish-forms five of the ten T-slots. Work speed and feed rates are the same as for roughing, with the exception that the feed is reduced to 0.004 inch per revolution for plunge cutting in forming the T-slots.

Turbine rotor-disc forgings are heated to between 2000 and 2150 degrees F., and held at this temperature for thirty minutes per inch of cross-sectional thickness. After rapid cooling in air, the forged discs are tempered at a temperature of 1150 to 1250 degrees F. for not less than four hours and again cooled in air. The forgings then have a Brinell hardness between 262 and 321.

Fir-tree serrations for gripping the turbine buckets are machined in the peripheral rims of the rotor-discs. Angularity of these serrations must be maintained within plus or minus 3 minutes, and the serrations must be equally spaced within 0.003 inch of the required basic positions. The cross-sectional view of one of the serrations shown in Fig. 4, indicates the dimensions, radii, angles, and tolerances that must be held in machining.

An innovation in jet-engine manufacturing is the use of a horizontal broaching machine to cut the fir-tree serrations in the rims of the turbine rotor disc. This operation is performed on a 132-inch machine, Fig. 5, made by Detroit Broach Co. and powered by Oilgear hydraulic equipment. The forged disc is clamped to a hydraulically indexed fixture, Fig. 6, that is mounted on a base which is set at the required angle. Each serration is both rough- and finish-broached in one stroke of the ram; the roughing broaches remove about 0.003 inch per tooth, and the finishing tools, 0.001 inch per tooth.

Rotary indexing is accomplished automatically, with limit switches preventing the ram from advancing until the disc has been indexed. Since chips broached from the heat-treated alloy forgings have a tendency to weld to the broach teeth, a brass disc is placed between the workpiece and fixture to shear the chips from the broach as it passes through the disc.

The bore and one face on the hub of each turbine rotor-disc are finished on a Springfield vertical, universal grinding machine, Fig. 7, maintaining the bore within plus or minus 0.0005 inch

Fig. 2. Special double-ram, vertical turret lathe employed to turn, face, bore, contour, groove, slot, and chamfer magnesium-alloy compressor-stator casings.

of the required size. In a subsequent operation on this same hydraulically operated machine, the disc-rim bores are ground to accommodate a spacer ring at assembly. Also, in the same set-up pilot surfaces (9.953 inches in diameter) on the hub peripheries are ground to receive the turbine rotor-shaft. The flange faces adjoining the pilot surfaces, and the 0.03-inch radii fillets at the roots of the disc-rim bores are ground with the face and rounded edge of the abrasive wheel.

For this operation, the turbine rotor-disc is located from its previously ground bore. A vitrified-bond aluminum-oxide abrasive wheel of 60 grain size is employed. The recessed wheel, 4 inches in diameter by 3 inches wide, is rotated at 5200 surface feet per minute, and the work revolves at 250 R.P.M. Eccentricity and run-out of the surfaces cannot exceed 0.002 inch total indicator reading, and the finish of the surfaces must be 32 micro-inches r.m.s. or less.

Substantial savings have been made in machining many of the parts for the Orenda turbo-jet engine by substituting mist cooling for liquid carbon dioxide or the flood system. In mist cooling, compressed air is passed through an air cleaner and pressure regulator to an injector. The injector syphons coolant from a reservoir, and a small orifice injects vaporized cutting fluid into the air stream. Rapid expansion of the high velocity air passing through the orifice reduces its temperature. Vaporization of the water in the coolant absorbs heat from the work, tool, and chip. Velocity of the compressed air insures rapid heat transfer in vapor form to the atmosphere. Lubrication of the chip as it passes over the tool is accomplished with the unvaporized constituents of the cutting fluid.

One installation of mist cooling which has given unusually good results is illustrated in Fig. 8. In this operation, ninety-one lugs are rough- and finish-milled in the inner cone of the turbine nozzle-box on a Cincinnati No. 3 horizontal milling machine. This jet-engine part is made from a stainless alloy. The work-piece is mounted on a fixture on the milling machine table, and indexed ninety-one times to cut the 5/16-inch wide by 5/8-inch deep slots between lugs. Three high-speed steel milling cutters (one roughing and two finishing), gang-mounted on an arbor, are rotated at 57 R.P.M., and the work is fed at the rate of 4 1/2 inches per minute.

An air cleaner, pressure regulator, 3-gallon coolant reservoir, and injector made by Air Conversion Research Corporation, are seen mounted on the left of the milling machine column. Compressed air at a pressure of 60 pounds per square inch is employed, the air being carried to a central distributing head by 3/8 inch pipe and the mist being carried from the manifold to the cut-

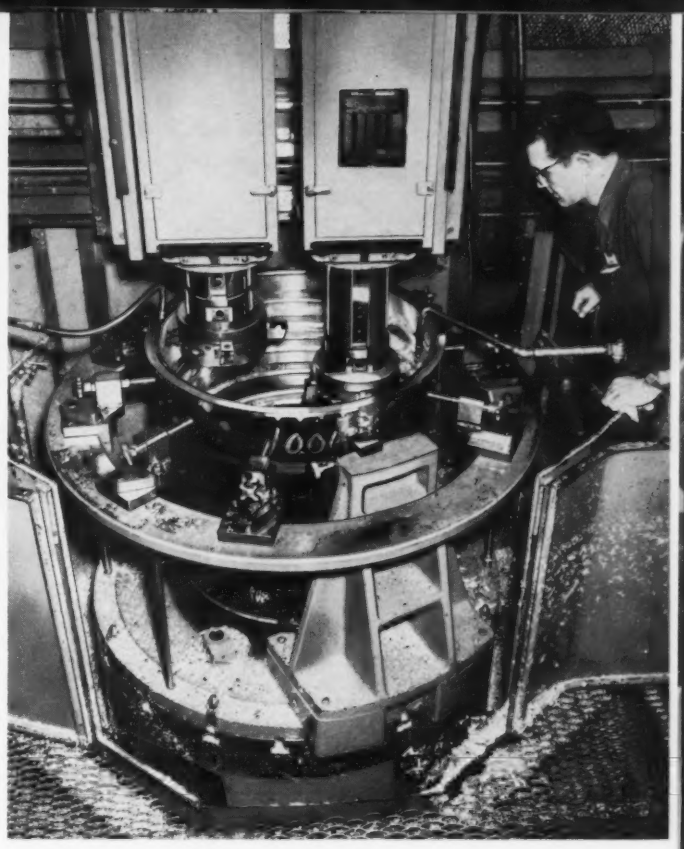
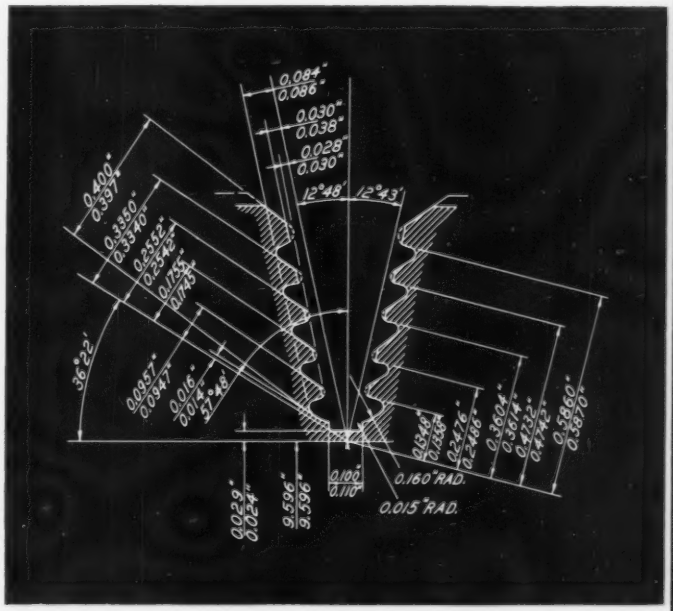


Fig. 3. Left- and right-hand rams each have a Man-Au-Trol unit to automatically control the horizontal and vertical movements of the rams.

Fig. 4. Cross-sectional view of one of the fir-tree serrations broached in the rims of turbine rotor discs for gripping the turbine buckets.



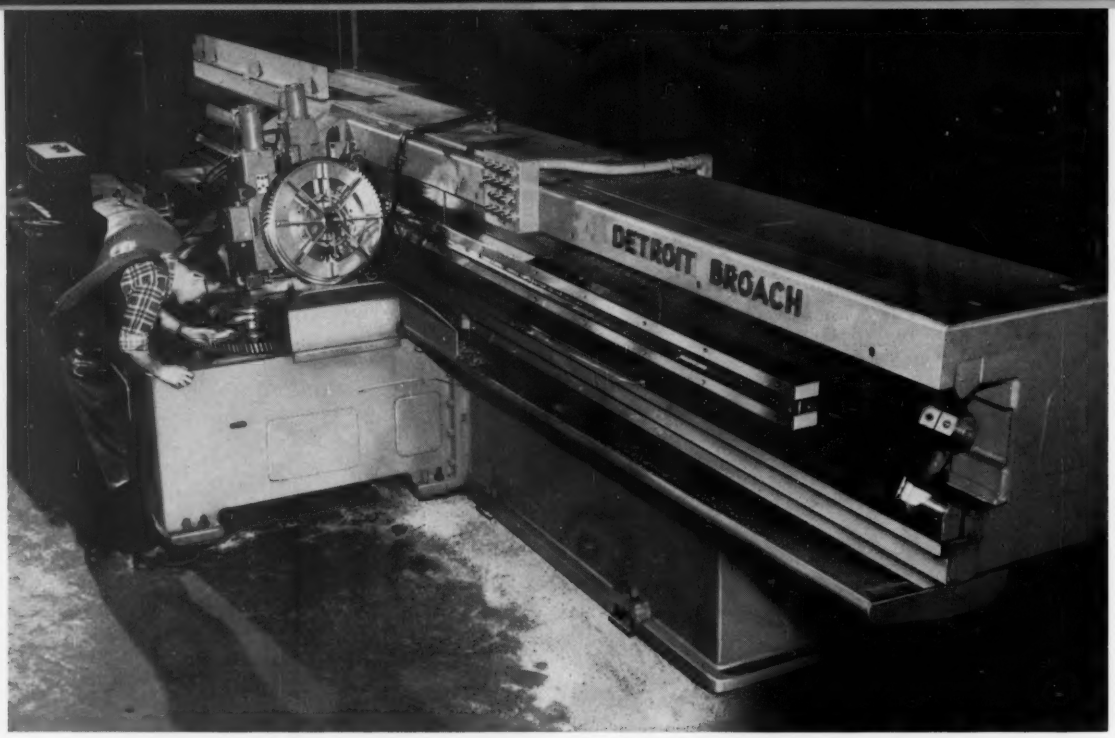


Fig. 5. Horizontal broaching machine for cutting serrations in turbine discs. Both first- and second-stage discs can be broached by changing the fixture.

ters by copper tubes having an inside diameter of 1/8 inch. Acro coolant used in this unit is a high film-strength solution of high molecular-weight hydrocarbon, diluted in the ratio of from 12 to 50 parts water to 1 part coolant. Tubes are positioned to direct the air streams and mist coolant toward the surfaces being cut—with the tube tips about 1 inch from the work surfaces and a a slight angle (5 to 7 degrees) with the peripheries of the cutters.

The number of pieces obtained with this set-up has been increased approximately 50 per cent. Other advantages include elimination of the need for repair of pumps, reclamation of coolant from

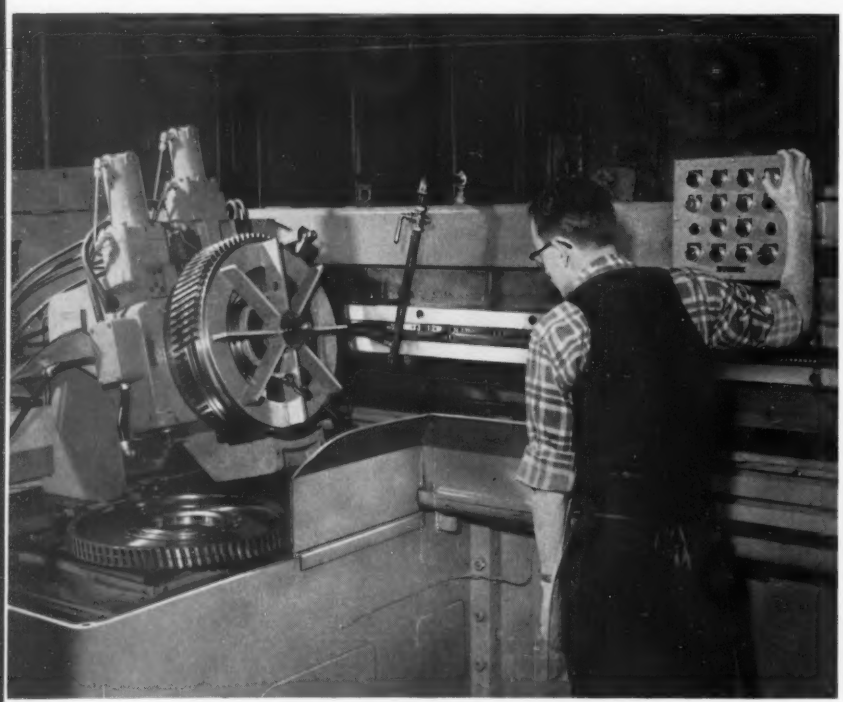


Fig. 6. A brass disc is placed between the work-piece and fixture to shear chips from hydraulically operated broach as it passes through the turbine rotor-disc.

the chips, and splash guards. Also, working conditions are improved because of cleaner and drier machines.

Outer casings for the turbine nozzle-box of the turbo-jet engine were previously made from castings. Now these casings are stainless-steel weldments. An interesting operation performed on the casing is illustrated in Fig. 9, where six large irregular holes are being profile-cut on an automatic, tracer-controlled milling machine. This Keller machine, built by Pratt & Whitney Division of Niles-Bement-Pond Co., is electrically operated.

A sensitive tracer, mounted near the top of a vertical slide, and a cutter spindle, mounted on the same slide below the tracer, move in unison. The tracer follows the bore of a flat template, and the cutter duplicates the shape in the casing. The welded casing is manually clamped to an angle plate mounted on the bed of the machine, and indexed 60 degrees after profile-milling each hole. A 5/8-inch diameter end-mill, rotating at 600 R.P.M., is employed for this operation. Accurate location of the work is insured by pins on the fixture that enter cooling air ducts (welded to the casing) prior to clamping.

Gas-tight welding of the six duct rings to the nozzle-box assembly is performed with the set-up seen in Fig. 10. While joining was formerly done with argon-shielded arc welding, it has been found that satisfactory results are obtained with unshielded metallic arc welding. The nozzle-box is clamped to a special fixture mounted on a

Fig. 7. Bore of the turbine rotor-disc is finished, to provide a locating surface for subsequent operations, on this vertical grinding machine.

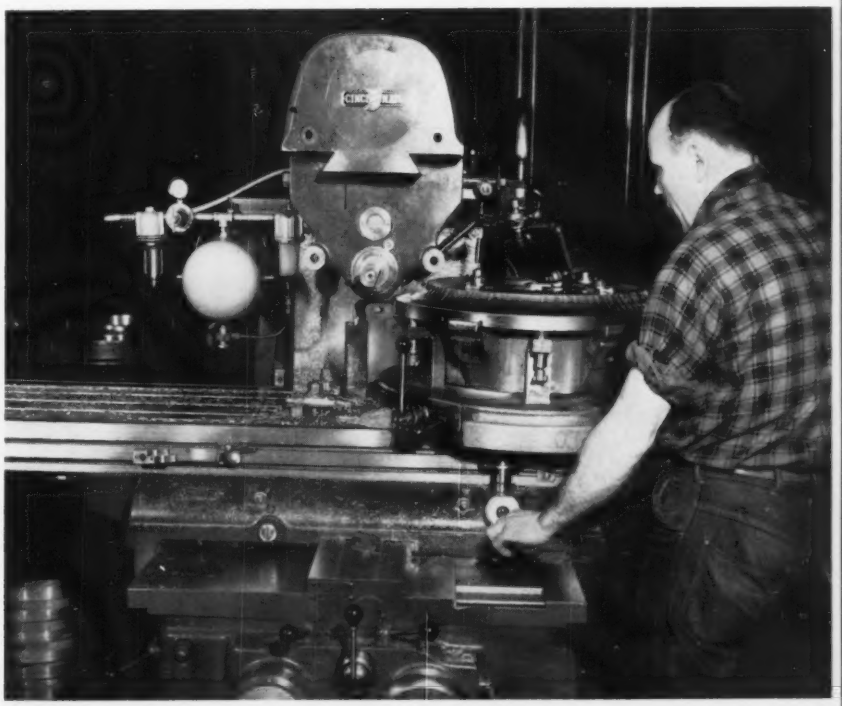


Fig. 8. Substantial savings, increased tool life, and improved working conditions have resulted from use of mist cooling in this milling operation.

Fig. 9. Automatic, tracer-controlled milling machine is used to cut six large irregular holes in outer casing of turbine nozzle-box.

power-operated welding positioner, locating by means of pins that enter cooling air ducts in the box. Duct rings are then clamped in place on the fixture, and a 1/8-inch continuous fillet weld is made around the periphery of each ring.

Redesigned stator segments posed a difficult production problem. These stainless-steel sub-assemblies, Fig. 11, each contain five stator vanes, an outer shroud, an inner shroud, and an outer brace. Since they operate at high temperatures, these parts must be heat- and corrosion-resistant, and their joints must be strong enough to withstand the stresses developed in operation. Joining difficulties have been solved successfully, and clean, bright, and strong sub-assemblies are obtained without warping by employing the Nicrobraz process developed by the Wall Colmonoy Corporation.

This process makes use of Colmonoy Nicrobraz powder, a heat- and corrosion-resistant, nickel-chromium-base alloy for brazing stainless-steel parts when the assembly has to operate at temperatures from 1200 to 1800 degrees F. Nicrobraz alloy has a hardness of approximately 60 Rockwell C before brazing, and a melting point of 1850 degrees F. At temperatures above 1900 degrees F., and in a pure, dry hydrogen atmosphere, the material flows readily into tight-fitting joints and alloys with the parent metal. The new alloy formed at the joints has a hardness of 30 to 35 Rockwell C, a higher melting point, and ductility, shear strength, tensile strength, and corrosion resistance about the same as that of the parent metal.

Parts to be joined by means of this process must have uniform surface conditions, and the joints must have small clearances (not more than 0.002 inch). Even press fits do not prevent the flow of brazing material into the joint. The stator vanes fit snugly into holes pierced in the inner and outer shrouds. Nicrobraz powder is carefully mixed with a liquid cement solvent to form

Fig. 10. Power-operated positioner and special fixture are employed in metallic arc-welding six duct rings to the jet-engine nozzle-box assembly.

Fig. 11. A heat- and corrosion-resistant, nickel-chromium-base alloy is applied to stator segment sub-assemblies in preparation for the brazing operation.

a paste that is applied, as shown, with a small artist's brush or eyedropper. Application is made in holes or along the surfaces where it will flow into the joints by capillary action. Holes in the outer shroud permit the alloy to braze the roots of the vanes to the shroud. Since holes cannot be provided in the inner shroud, the mixture is applied around the surfaces to be brazed. Nicrobraz in wire form, 1/16 and 1/8 inch in diameter, is placed inside the sub-assemblies where paste cannot be applied. A special stop-off powder, mixed with the same cement, is applied to other surfaces on which the material should not flow.

Prepared stator segment sub-assemblies are placed in stainless-steel wire baskets, carefully spacing the parts to permit circulation of the atmosphere employed for brazing. The loaded baskets are stacked in a retort, Fig. 12, and a bell is lowered over the stack. After clamping the bell to the retort by means of four hooks, the base of the retort is packed with 60 grit silica sand.

To prevent oxidation of the chromium, which would interfere with brazing, a reducing atmosphere of pure, dry hydrogen is circulated among the parts during the operation. The hydrogen, under a pressure of 30 pounds per square inch, passes by pipe from a manifold (supplied by 220-cubic-foot bottles) through a dryer and dehumidifier, and a heat-resistant rubber hose to a 1-inch diameter tube extending down through the center of the retort. Holes in the tube allow the hydrogen to escape into the retort, where it circulates among the parts to be brazed and seeps out through the sand into the atmosphere. Purging of the retort is continued for twenty minutes to one hour, depending on the load, with the hydrogen flowing at the rate of 125 cubic feet per hour.

The bell and retort, with hydrogen still flowing at the same rate, are transferred by overhead crane and lowered into a furnace, Fig. 13, that has been preheated to a temperature of 2150 degress F. The pot type furnace, having a swinging split door on its top, is heated by manufactured

Fig. 12. Parts to be brazed are placed in baskets that are stacked in a retort. A bell is lowered over the retort and hydrogen is passed through the load.

Fig. 13. A propane-gas-fired, pot type furnace operating at a temperature of 2150 degrees F. is employed for brazing the stainless-steel stator segments.

propane gas that is mixed with air and burned at eight ports on a circular manifold. When the furnace doors are closed, it requires from twenty minutes to one-half hour to bring the furnace back up to a temperature of 2150 degrees F. In about ten more minutes, the hydrogen atmosphere in the bell reaches the same temperature. Two recording potentiometers are provided to indicate bell and furnace temperatures.

Hydrogen, continuing to flow into the bell at the same rate, burns off in the furnace as it seeps through the sand. After one-half hour at the required temperature, the bell is removed, placed on a stand, and cooled by fans blowing air on the bell. In about one and one-half to two hours, the bell has cooled to about 400 degrees F.; the rate of hydrogen flow is reduced from 125 to 60 cubic feet per minute; and cooling is continued until a temperature of 200 degrees F. is reached.

At this point, the hydrogen supply is shut off, the bell is lifted, and the parts are removed. Stop-off material is washed from the parts with hot water, and they are inspected. To rebraze any joints not passing inspection, the parts can be processed through the same cycle without melting any of the previously applied braze material.

Straightening of wing-tip tanks for airplanes is done at Martin, Baltimore, Md., by means of a vacuum technique which pulls dents out. A plate, formed to the contour of the tank, is placed over the dent and sealed with a sponge-rubber gasket. Vacuum is applied, and the dents pop out.

Synthetic Cutting Compound with Exceptional Properties

A SYNTHETIC product which, when dissolved in water, yields a safe and economical cutting solution for use in all types of machine tools has been announced by the Shell Oil Co., New York City. This product, called Dromus Oil E, is made entirely of synthetic ingredients. The working solution prepared from this liquid is said to have exceptional cooling properties that make high speeds and feeds possible. Dromus Oil E, actually dissolves in water thus forming a true solution instead of an emulsion. Even on long standing, no separation is noticeable and the solution is stable at all temperatures normally encountered.

The new product can be mixed with a large volume of water to utilize the latter's high cooling effect. Its addition to water prevents rusting of parts or equipment. It also improves the wetting characteristics of the solution as illustrated in Fig. 1, to reduce friction between tool and chip and increase the cooling effect still further. As shown in Fig. 2, the new synthetic cutting fluid is almost a clear transparent liquid. It will not leave any oily or greasy deposits in the event that it is accidentally spattered on clothing.

A properly prepared solution will not froth or foam objectionably, or form hard-to-clean sludge. Chips and grinding grits are said to settle-out rapidly so that most of these are not recirculated through pumps and cooling systems. If the machine is to be cleaned or dismantled, the clear coolant may be syphoned off the top and used again.

The formula includes more than a dozen ingredients, each having a specific function to perform. The cutting fluid may be added to water in any ratio (or water to it) without fear of inversion or instability. For metal-cutting machinery such as lathes, boring mills, drill stands, milling machines, and the like, a solution of thirty parts of water to one part Dromus Oil E is recommended. Depending on plant experience, this ratio may be changed to as high as 40 to 1 or as low as 20 to 1. For grinding machines of all types, the dilution may be even higher, ranging up to 70 to 1. Such a solution has been used in grinding cast iron without any signs of rust. A good average dilution recommended for grinding operations consists of 50 parts of water to 1 part Dromus Oil E.

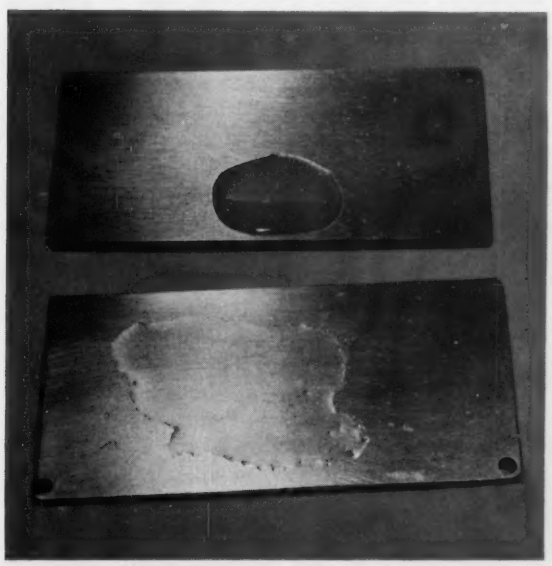


Fig. 1. Dromus Oil E, foreground, spreads out thinly, wetting a large area, thus increasing cooling effect of the cutting compound. Equal amount of conventional soluble oil emulsion, background, indicates by comparison the exceptional wetting property of the new compound.

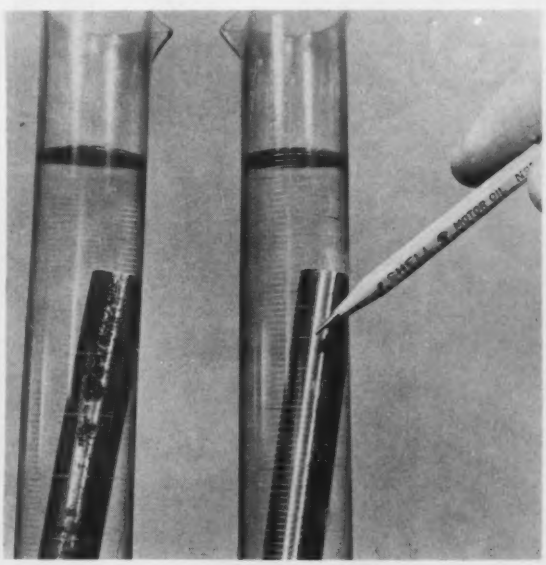


Fig. 2. Carbon-steel drill rod, at right, immersed in Dromus Oil E solution, 1 part to 30 parts water, did not rust after six months' time. Another sample which was placed in tap water at room temperature rusted, as shown at left, in about two hours.

Ultrasonic Machine Cuts Precision Holes in Hydraulic Sleeves

By William W. Wood, Tool Research Engineer
Chance Vought Aircraft, Inc., Dallas, Tex.

BECAUSE high-speed jet aircraft are so responsive to slight changes in their ailerons, rudders, or elevators, precise amounts of hydraulic fluid are required to move these controls. Chance Vought Aircraft, Inc., had a need for a sleeve containing several precision, rectangular-shaped holes to feed hydraulic fluid into the control system at exact rates. After experimenting for more than a year with various methods of machining these holes, the company's tool research engineers solved the tough problem by using ultrasonic machining.

The job called for a rectangular slot 0.050 inch wide and 0.125 inch long for one type sleeve, and 0.030 by 0.125 inch for another. Extreme tolerances were set up both as to dimensions and locations of the slots since the amount of fluid to be fed through the holes had to be exactly metered. Chance Vought first tried to make the slot by piercing the hole slightly under size and finishing with a shaving operation. This produced a bad "break-out" on the inside diameter, which was the most important part of the orifice in terms of oil flow. The second method was to machine three sleeves, with the orifices milled into the edges of two, and then join the trio together. This failed because a perfect fit, preventing fluid leakage, could not be attained.

It was then decided to try ultrasonic machining with a Cavitron machine, Fig. 1, made by the Sheffield Corporation. This method involves the use of a high-frequency, alternating electrical current which can be made to oscillate a tool the size of the desired orifice 30,000 times a second. The tool is kept immersed in an abrasive slurry of fine boron-carbide grit suspended in water. The tool strikes the grit and drives it against the surface of the work-piece, causing a low-speed, highly repetitive rate of erosion.

Because this action also wears away the tool, rough machining is done first with the work held in the chuck seen at the left in Fig. 2. Then the hole is finished to specific size in the chuck shown at the right. For roughing, a 280-grit abrasive is used, and an 800-grit abrasive for finishing. The slurry mix contains about 60 per cent grit and 40 per cent water, and is used over and over again.

Corners of the slots are cut sharp with a maximum radius of 0.002 inch; the slots are held symmetrical about their center lines within 0.001 inch; sides of the slot are maintained straight within 0.0002 inch; and the four edges of each orifice are held perpendicular within 0.001 inch full indicator reading at the sleeve bore. No burrs or break-outs are permitted, and the maximum allowable stagger of the orifices is 0.001 inch.

Specially built brass jigs are used to resist corrosive and erosive action of the slurry. These jigs locate the sleeves axially, radially, and symmetrically about the center line. Each jig has a V-block with a pin in the bottom for radial alignment, and an end plate for positioning the sleeve axially, by locating against a ground

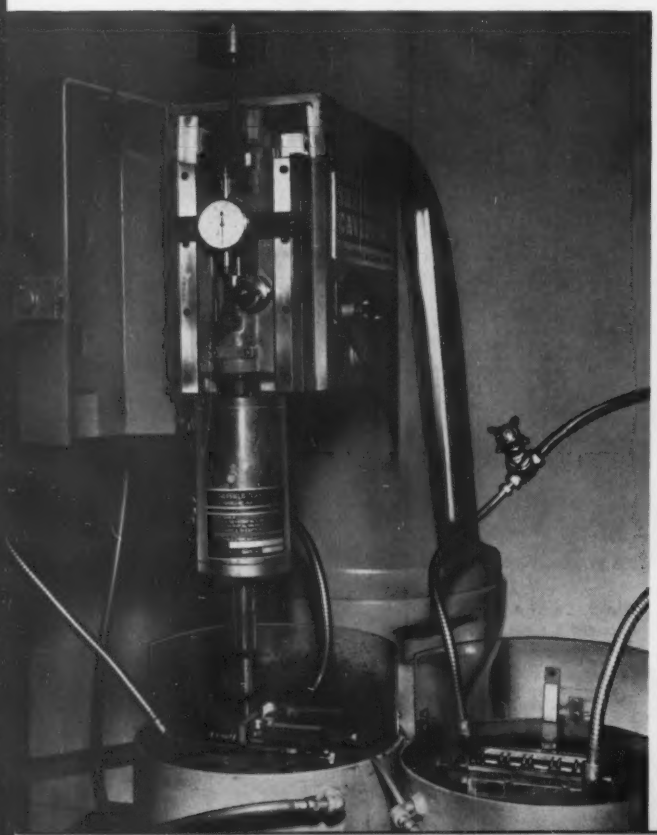


Fig. 1. Ultrasonic machine tool makes use of a rapidly oscillating tool and an abrasive slurry of fine boron-carbide grit suspended in water to cut holes in work.

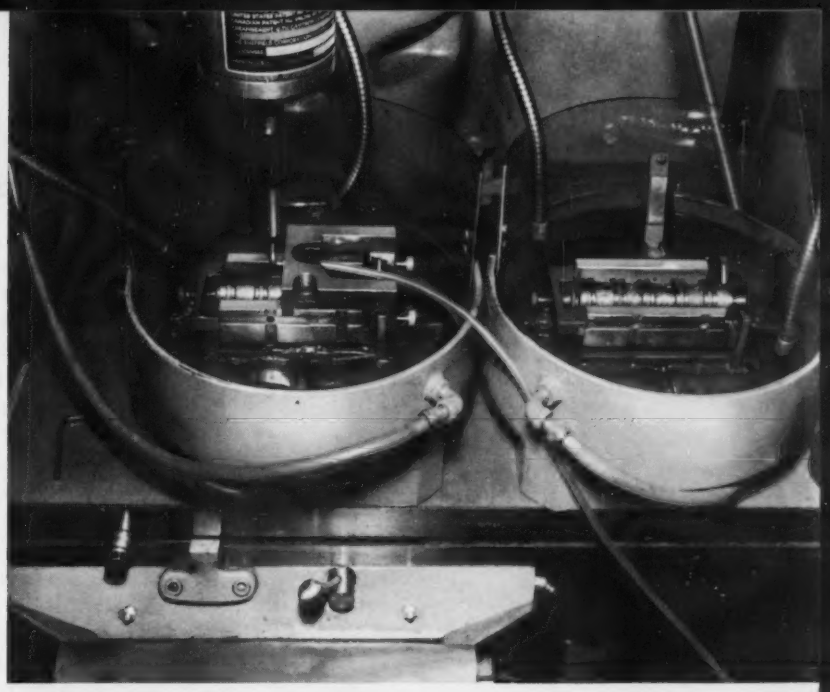


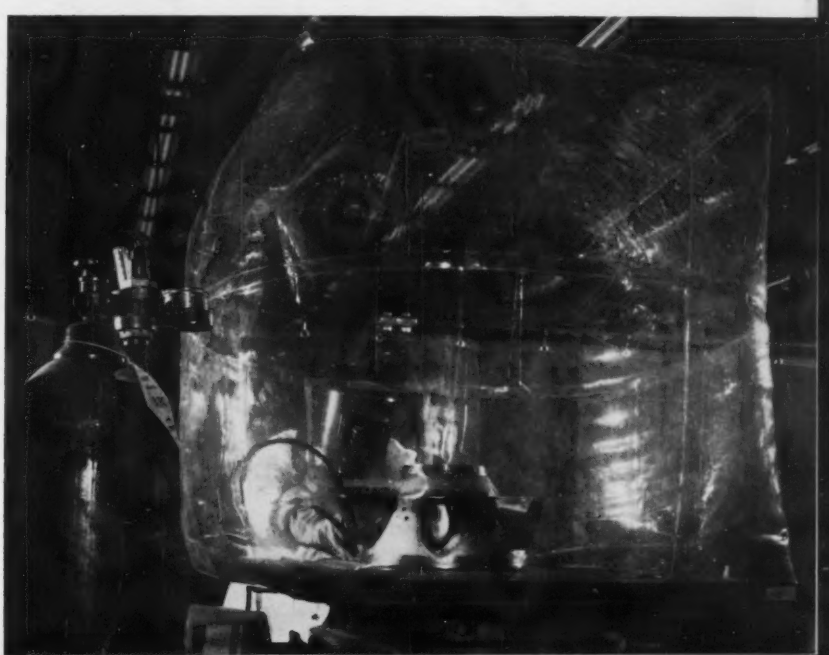
Fig. 2. Rectangular-shaped holes, held to close tolerances for both size and location, are rough machined in set-up at left, and finished at the right, of this ultrasonic machine.

shoulder on the sleeve. Clamps are used to secure the sleeve against the V-block and to insure proper fitting against the end plate.

Sheffield Plunjet air gaging cartridges are used in conjunction with a Sheffield column type Precisionaire gage to locate the tool bit relative to the sleeve prior to machining. These gages can be read to 0.0001 inch and have a range of 0.0003 inch. The Plunjets are fitted into holders bolted to the end plate and the edge of the V-block, thus insuring proper alignment.

It is important that the tool bit be attached securely to the tool-holder. Not only must the bond between bit and holder be kept free of cracks and gaps, but it is essential that the axis of the bit be parallel with the ways of the vertical head. A good bond is obtained by brazing the tool bit to the holder in a specially built jig, and alignment is inspected by movement of the Plunjet across the bit both laterally and longitudinally. Any slight misalignment is corrected by pushing with the fingers, or by tapping lightly with a hammer.

The ultrasonic method of machining has other applications besides the cutting of such precise holes. For example, special dies of intricate shape can be machined. Since hardness of the material is not important, dies or parts can be machined after heat-treatment, thereby removing the problem of distortion after heat-treating.



A transparent plastic tent, developed at the Des Moines, Iowa, plant of the Solar Aircraft Co., permits titanium parts to be welded in a controlled atmosphere. The tent, a vinyl bag equipped with a zipper, is fastened to the base of the welding table and filled with an inert gas. The operator wears long-sleeved rubber gloves sealed to the tent. Bathing the work in inert gas prevents a brittle weld, by excluding oxygen, nitrogen, and hydrogen from the molten metal.

U.S.A.F.-Alcoa Plant

FORMAL operation of the United States Air Force's multi-million-dollar forging facility in Cleveland, Ohio, began last month upon signal from Air Force Secretary Harold E. Talbott. Operated by the Aluminum Co. of America, the plant is adjacent to Alcoa's long-established casting and forging works. Two towering hydraulic forging presses—a 35,000-ton United press, and a 50,000-ton Mesta press—form the heart of the plant. Joining the two Loewy giants at the U.S.A.F.-Wyman-Gordon plant in North Grafton, Mass., (see article starting on page 164), the presses will produce heavy precision forgings for all types of aircraft.

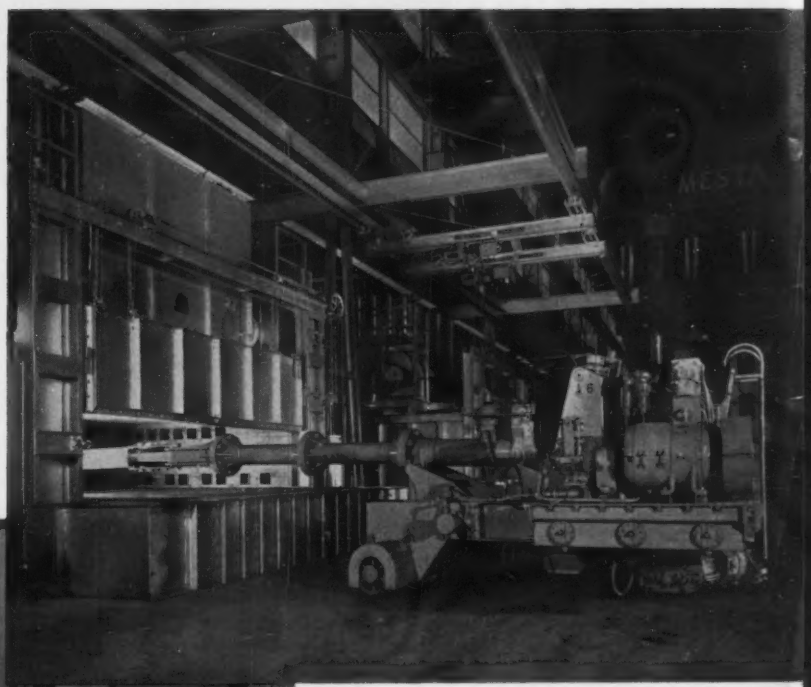
The plant, started in May, 1953, was built for the Air Force at a total cost of approximately $40,000,000. It covers 26 acres of land, with 12 acres (514,345 square feet) under roof. Alcoa is operating the plant under a leasing arrangement which returns to the Air Force 4 per cent of gross sales from products made on the presses.

The 50,000-ton Mesta press was built at a cost of $7,450,000 including foundations and related equipment. It stands 50 feet above and 36 feet below floor level. Running through the press from top to bottom are eight massive columns having a diameter of 40 inches and a length of 76 feet. Four sections of each column are threaded for nuts 52 inches in diameter.

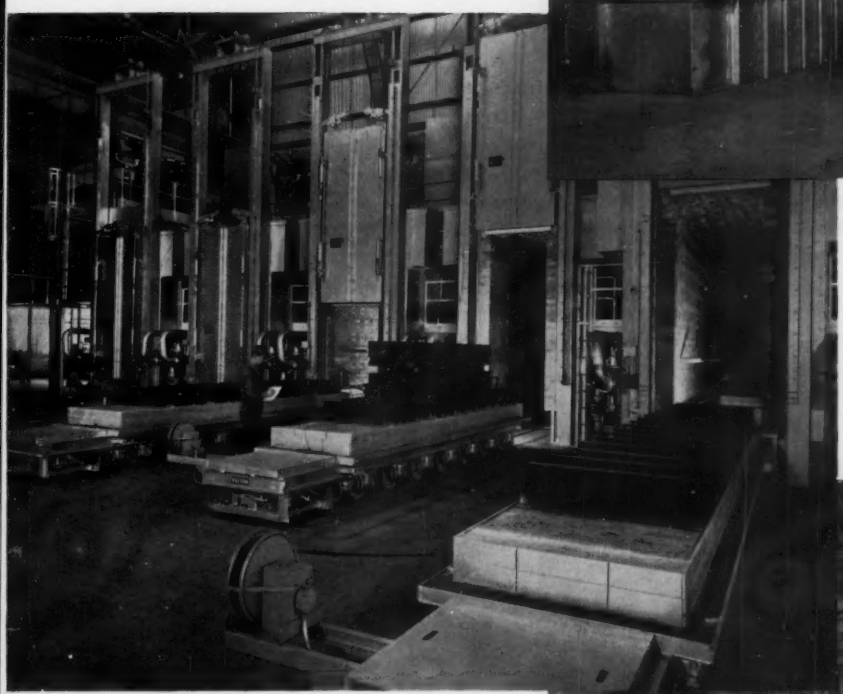
The 35,000-ton United press, with foundations and related equipment, cost approximately $8,250,000. The eight cylinders and eight columns are so arranged that the upper entablature is essentially a group of four two-column units. This feature leaves the units free to stretch vertically, independently of one another; at the same time, the units are keyed and bolted against lateral movement. Columns are 34 inches in diameter and 61 feet long. The columns are bored, so that the fluid medium for the hydraulic system flows through them, thus serving as pipes as well as the principle tension members

These forging giants now are squeezing out huge light-alloy parts for military aircraft. Because of their capacities and pressures, new concepts in aeronautical design can be established.

Goes into Operation

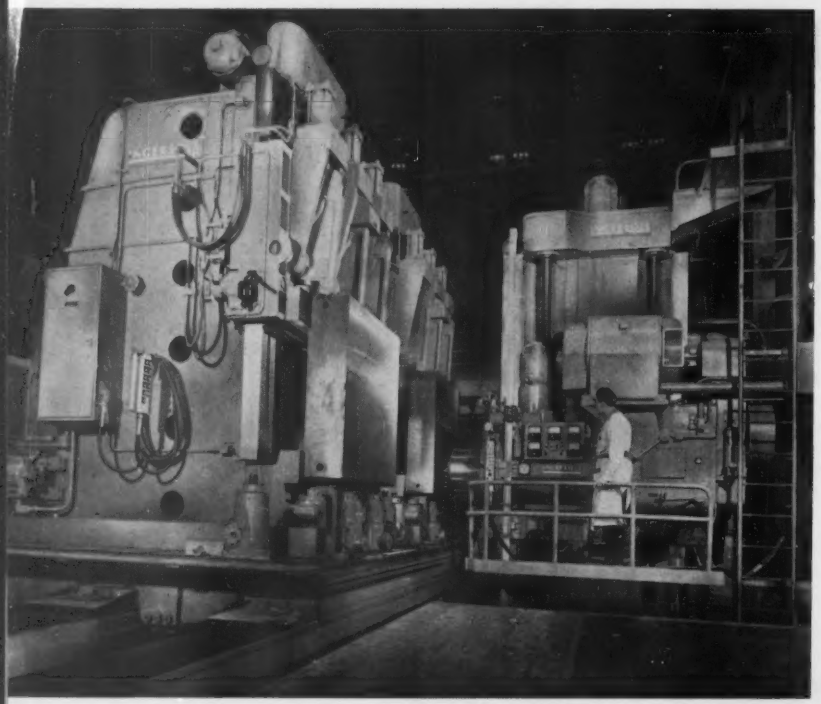


(Right) A mechanical manipulator is shown removing forging stock from an R-S preheating furnace immediately prior to inserting it in the 50,000-ton Mesta press seen in the background.



(Left) Before being set up in either the 35,000-ton or 50,000-ton press, die members are heated to proper temperature for forging in this battery of Swindell-Dressler special furnaces located at one end of the press bay.

(Right) Movements of the 50,000-ton Mesta press are directed by the operator from a control panel. The press has a maximum stroke of 6 feet, with a working stroke of 1 foot designed to operate at thirty cycles per hour.



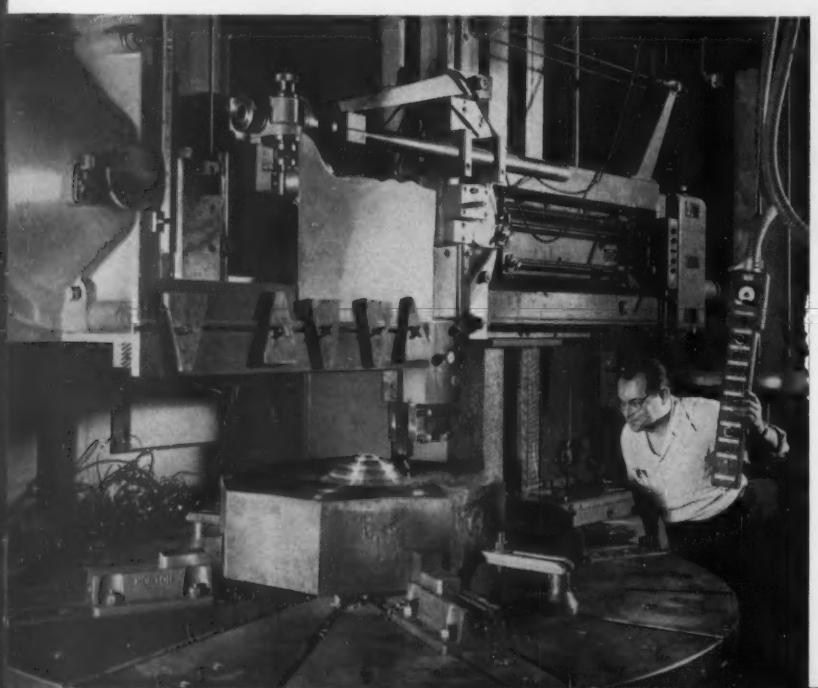
This mammoth Ingersoll milling machine rapidly finishes the flat surfaces of the huge die-blocks, preparing the forging cavities for subsequent die-sinking and cutting the shanks of the die.

of the press. Cylinders are supported at the top, rather than on flanges at the open ends, in this way creating an improved stress condition.

The die shop, an integral part of the plant, has seventeen major die-sinking machine tools, as well as extensive areas for plaster model-making, pattern-making, and die lay-out. Die polishing is done in closed booths having air-cleansing systems. Dies are brought to the press bay on a 100-ton electrically operated transfer car, where they are picked up by a 200-ton crane.

There are nineteen furnaces for soaking ingots, for heating forging stock, and for heat-treating and aging semi-finisned forgings. In addition, dies are preheated in nine special radiant type car bottom furnaces. To eliminate distortions produced in the forgings by heat-treating, six large straightening presses with a capacity of 300 tons have been installed.

Fluorescent penetrant and ultrasonic Reflecto-scope inspections figure prominently in quality control. Other checking and testing equipment is located in a controlled-temperature room.



One of the major machine tools of the die shop is this Giddings & Lewis 84-inch vertical boring mill. Equipped with a tracer attachment, it is generating the contour of a die member.

Machine Tool Builders Boost September Show

THE Machine Tool Show to be held in the Chicago International Amphitheatre, September 6 to 17, inclusive, was uppermost in the minds of the members of the National Machine Tool Builders' Association as they attended the Fifty-Third Spring Meeting held at the Edgewater Beach Hotel in Chicago, Ill., on May 4 to 6.

In a stirring address, William E. Rutz, chairman of the Machine Tool Show Committee and executive vice-president of the Giddings & Lewis Machine Tool Co., described the elaborate preparations that had been made for exhibiting the wide variety of machines that will be brought to the attention of the men in the metal-working industry who will attend the Show. Approximately 440 different types of machine tools will be exhibited, some of them of enormous size and weight.

In a dramatic manner, Mr. Rutz unveiled a replica of a typical entrance to a circus which advertised the coming event as "The World's Best Investment in Action." One poster pointed out the high obsolescence of machines now in use in America's machine shops. Another proclaimed that if machine tool users were to avail themselves of the machines to be shown next September, our national production in metal-working shops could be increased 25 per cent within the next five years.

Mr. Rutz quoted from a former address of M. A. Hollengreen, president of the Association and president of the Landis Tool Co., as follows:

"These old machines are a drag upon the nation's economy. They act as a brake upon our cycle of perpetual progress. Everyone knows that sooner or later they must be replaced. Most of them should have been replaced long ago. There never will come a better time to replace them than right now, before they do any further damage to our economy.

"Here is one guarantee that can be made with full assurance. The machine tool industry can guarantee the metal-working industry of the United States that if it will undertake immediately a sound and comprehensive program of replacement of obsolete machine tools, the savings effected will total over a billion dollars a year, and, in addition, the net result will be an increase in over-all employment."

In another address entitled "The Open Door," Alfred V. Bodine, chairman of the Public Relations Committee and president of the Bodine Corporation, stressed the necessity of promoting the Show through advertising, magazine, and newspaper publicity, Rotary Clubs, and other means. He pointed our the fact that the Show will represent a huge investment on the part of the exhibitors and therefore they should do their utmost to attract a large attendance of their potential customers.

Mr. Hollengreen, in his address "The Cost of Not Having," mentioned that on a recent visit to Washington he called on many important persons in government circles to extend invitations to the Show. He found those officials conscious of the important role that the machine tool industry plays in the defense of the nation and alert to the need of their cooperation with the machine tool industry to make the contribution of that industry truly effective. Mr. Hollengreen stated that with this favorable atmosphere in Washington, September will be an ideal time to have the Show.

The Show will provide an opportunity to point out the great gap between the new machines available and the old types that customers are using daily in their shops. He stressed the point that metal-working plants are paying too much for the doubtful pleasure of retaining their old machines—of not having modern machines that can make the most of modern tools—of not having present-day high-powered, high-producing and accurate machines.

Tell Berna, general manager of the Association, referred in his report to the Show and to the work being done in Washington under the supervision of the Government Relations Committee as the outstanding projects of the Association at the present time. He also discussed at length the accomplishments of the various standards committees and called attention to divergences in the interests of American and foreign representatives of the International Standards Organization. Mr. Berna also referred to the effective cooperation of the Advertising and Marketing Research Committee and its advertising counsels in promoting the Show.

Everett M. Hicks, chairman of the Government Relations Committee, and vice-president and manager of the Grinding Machine Division of the Norton Co., gave a detailed report on Washington problems. He covered such important subjects as import and export of machine tools,

tariff regulations of certain European countries, permanent defense capacity, procurement policy, and tax policy.

The tremendous technological advances during the past thirty-five years in the design of machine tools and other equipment used by automobile manufacturers was emphasized by R. J. Emmert, executive in charge of facilities and processes, manufacturing staff, General Motors Corporation. Mr. Emmert outlined specific changes and improvements in machine construction that would meet manufacturing and maintenance requirements of the automobile industry.

A highly educational and, at times, humorous address was given by Louis Polk, first vice-president of the Association and president of the Sheffield Corporation. In this address entitled "Small Talk—Or the Seventh Decimal Place," Mr. Polk pointed out that whereas Watt's steam engine became a success because Wilkinson was able to bore a cylinder so true that a worn shilling could not be inserted between the piston and the bore, today's measurement requirements seem beyond the bounds of reality. He pointed out measurement requirements in the nuclear field and referred to the "jiffy"—the length of time required for light to travel 1 centimeter. "This," he commented, "is not a very long period when we reflect that light travels 186,000 miles per second. Today's fastest computers use up to 30,000 'jiffies' for a calculation." He also referred to the "barn" which measures the area of an atom, and a "shed" which is equal to one millionth of a "barn."

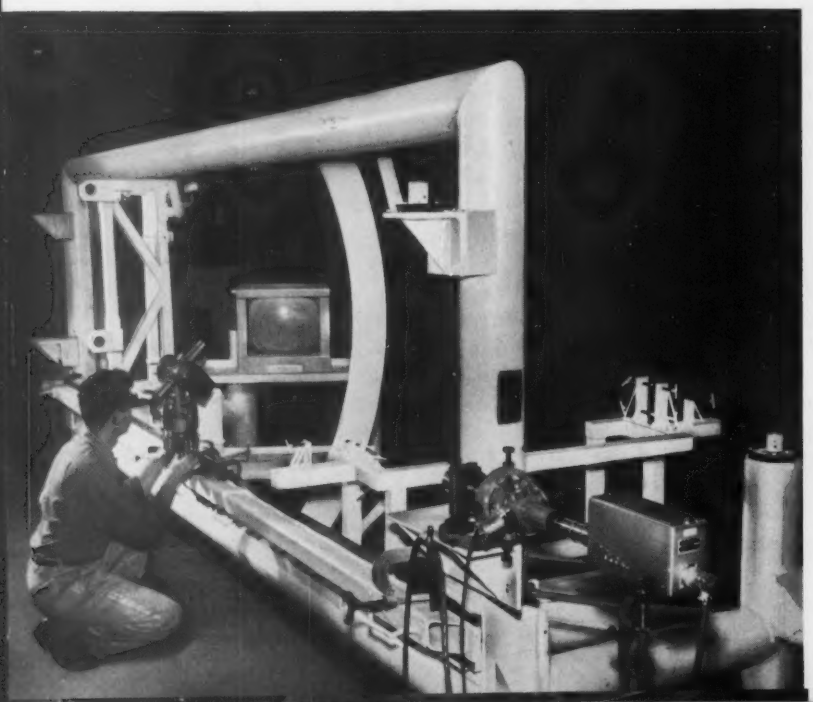
Television Increases Accuracy of Aircraft Jigs

USE of standard industrial, closed-circuit television parts has increased 300 times the accuracy of the assembly jigs on which the DC-7C transport is being built by Douglas Aircraft Co., Inc., Santa Monica, Calif. The system uses telescopes and targets for the optical reference lines from which parts of the jigs are positioned. The television camera, focussed on the eye-piece of the telescope, broadcasts the data to a table type TV receiver.

With the data magnified 300 times on the screen before him, the operator can adjust the Optical Square more quickly (in five seconds instead of the minutes previously required) and more accurately (to 0.00001 inch).

The basic principle of the Optical Square, developed by Douglas, was not altered by the introduction of the closed-circuit TV. Equipment required but two tapped and two dowel holes to mount the RCA TV-Eye at the back of the alignment telescope. A target is etched on the objective lens of the telescope and a light is beamed through the telescope at a mirror on the Optical Square. The target image is reflected back to the reticle (the cross hairs of the telescope) and when the center line of the reflected image coincides with the intersections of the cross hairs, the Optical Square is 90 degrees to the line of sight.

To an operator sighting through the telescope the image would be approximately 1/16 inch in diameter; it is broadcast to the RCA receiver as an image about 19 inches in diameter. Not only does the enlargement increase accuracy in superimposing the target on the reticle, but it also eliminates eye-strain, permits one man to do his own alignment, and permits simultaneous observation to be made by the tool inspector and the jig builder.



Television camera (right) is aimed at eye-piece of a jig transit. A target, etched on the focal plane of the transit, is projected by a light beam to the Optical Square on which there is a mirror. Through a closed circuit, the image of the target is enlarged 300 times on the TV screen thus facilitating jig adjustment.

Westinghouse Nineteenth Annual Machine Tool Electrification Forum

A NEW development in machine tool controls—Westinghouse Cypak Systems—was a highlight of the Nineteenth Annual Machine Tool Electrification Forum held at the Hotel Statler in Buffalo, N. Y., on April 19 and 20. Cypak controls are essentially relay systems that have no moving parts so they are not subject to wear, erosion, or environmental conditions. Aside from their high reliability, they represent a means for obtaining future machine tool controls of greater complexity than is presently possible.

A variety of interesting technical papers dealing with electrical developments of special concern to the machine tool industry—particularly as regards automation—were presented in the morning sessions. Panel discussions in the afternoon sessions provided a question and answer period on the contents of the technical papers presented earlier and permitted examination of electrical problems in today's automotive and farm equipment plants.

Turret Lathe Control by Magnetic Tape

A magnetic-tape controlled automatic turret lathe was the subject of a paper by Leonard Hesse, chief electrical engineer, Gisholt Machine Co. As pointed out by Mr. Hesse, most of the problems in tape control of machine tools center around practicability—that is, ease of maintenance and operation, as well as economy in initial and operating costs on virtually all types of work.

Spark Gap Tracer

Some of the inadequacies of present tracer controls prompted the design of a tracer based on the spark gap principle, according to a paper by E. E. Kirkham, Pratt & Whitney Division of Niles-Bement-Pond Co. The stylus of this new type of tracer control never touches the model; it traces by maintaining a constant spark gap between the model and the stylus at all times. No operating force is exerted on the model so that relatively soft materials such as plaster or plastics may be used in its fabrication.

Ultrasonic Impact Grinding

The application of ultrasonics to the impact grinding principle was described in a paper by Ralph Moschella of the Raytheon Corporation. According to Mr. Moschella, ultrasonic impact grinding has been successfully applied to cutting, shaping, slicing, drilling, engraving and grinding many materials to tolerances of plus or minus 0.0002 inch and finishes to 8 microinches. The process is particularly successful in machining unusual or difficult shapes in almost all kinds of materials.

Radio Interference Reduction for Machine Tools

Two of the papers presented at the forum were concerned with the suppression of radio interference in machine tools. L. W. Thomas, radio interference consultant for the Navy Department, described how certain types of machine tools are sources of radio interference in electronic and communications equipment when operated in the immediate vicinity.

In a paper entitled "Methods of Radio Interference Reduction for Machine Tools," C. D. Fahrnkopf, Westinghouse Electric Corporation, pointed out some of the means by which interference can be reduced or eliminated.

Other technical papers presented at the forum included, "A Low Inrush Type of Control for Large Machine Tool Motors," by Kendall H. Spencer, electrical engineer, Blanchard Machine Co.; "Semi-Conductors in Machine Tool Control," by R. B. Immel, Westinghouse Electric Corporation; and "The Re-Rate Motor—Its Thermal Capacity in Relation to Duty Cycle Drives," by R. F. Woll, Westinghouse Electric Corporation.

Luncheon speakers were M. H. Hollengreen, president, Landis Tool Co., whose subject was "The Machine Tool Industry Today," and H. N. Muller, Jr., assistant to the vice-president, Westinghouse Electric Corporation, whose topic was "Engineering World of Tomorrow." Colonel Willard F. Rockwell, chairman of the board, Rockwell Mfg. Co. and Rockwell Spring & Axle Co., who spoke at the conclusion of the banquet, presented an analysis of "The Economic Effects of Taxation on the Machine Tool Industry."

Over 500 electrical engineers, machine tool builders, and members of the technical press attended the Forum. The increasing attendance at these annual meetings is testimony to the esteem in which they are held.

Louis Pelletier

1871—1955

THE buoyant, happy spirit of Louis Pelletier is no more. "Pel," as he was affectionately known to his countless friends, passed away in New York City on Monday, April 18, after a long illness that had confined him to his home and bed for several years.

Louis Pelletier was born in Wisconsin on June 3, 1871, and was always proud of his French-Canadian ancestry. He was a graduate of Racine College, having helped to earn his way through college by performing such colorful tasks as selling gold watches to lumberjacks and preparing fish for canning. His oratorical ability was first demonstrated when he stumped the West for William B. McKinley during the Presidential campaign of 1896. As one of Mark Hanna's boy orators, he invaded the Free Silver States at considerable personal risk. On one occasion the sheriff of a small town hid him in the local jail until an angry crowd had dispersed.

Mr. Pelletier started in the publishing business with the Simmons-Boardman Co., and as a young man, promoted an important railway issue that took him on an extended business tour through Europe. In 1909, he joined MACHINERY as an advertising representative, and for many years was manager of the New England and New York City territory. He started a gradual retirement in 1946 after thirty-seven years of active service.

Pel's friends were legion because he had a God-given charm seldom bestowed on man. He inspired optimism wherever he went. His many anecdotes relating to his youth and daily experiences will long be remembered. A noble character has gone to his reward.

Electrolytically Formed Coating for Magnesium

A LOW-VOLTAGE alkaline chromate process for depositing coatings on magnesium alloys has been investigated by the National Bureau of Standards electro-deposition laboratories, under the sponsorship of the Department of the Army. Coatings produced by this method provide protection against salt-spray corrosion equivalent to that of coatings obtained from other anodizing processes currently used. This National Bureau of Standards process is potentially more economical, however, since it uses a low-voltage power supply and only two chemical constituents other than water.

The process is similar to electroplating except that alternating current is used instead of direct current, and the coating is formed on both electrodes. Some material is deposited out of the solution onto the electrodes in the anodizing process, but the coating is mainly material formed by the chemical reaction between the metallic electrode and the components of the electrolyte. The method for coating magnesium alloys differs from the acid chromate and the HAE anodizing processes in two respects: (1) it operates at a voltage of 10 to 12 volts alternating current; and (2) the electrolytic bath contains only sodium or potassium hydroxide and the corresponding chromate, plus water. A current of 80 to 140 amperes per square foot is passed through the bath twenty to forty minutes at a temperature of 150 to 170 degrees F.

The coating is smooth and gray-green in color, but not as uniform in appearance as either the HAE or the acid chromate coatings. The surface exhibits some sheen if the initial surface is very smooth. Gas adsorption measurements reveal that the coating has a smaller effective surface area than HAE coatings.

Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Interest Will Germinate But How Will It Terminate?

THE market demand for a staple commodity, such as eggs, depends primarily on price and supply. Each supplier tries to get a larger share of an existing egg market. This is not so with improved machinery and other manufacturing equipment. The size of the market depends on what sales managers and sales engineers do. Market demand or sales opportunity, though affected by business conditions, is far more dependent on creative salesmanship.

One cannot tabulate customer demand as a fixed figure, because most potential customers do not fully recognize their need. The extent of demand for a new thread grinder or an electronic control depends on how well the potential customer is informed concerning the dollars that can be saved and earned by improving his product through the use of the new machine and, at the same time, decreasing the product cost.

No better sales opportunity will exist in the near future than the Machine Tool Show, the Production Engineering Show, and the Coliseum Machinery Show to be held in Chicago, Ill., from September 6 to 17, for the metal-working industry. What more can be asked for than a vast assembly of potential customers drawn together in one city, eager to learn how to make greater profits? What greater opportunity to promote and explain? That's what selling is. What greater chance to acquire a list of live prospects?

When the writer attended the Machine Tool Show in 1947 in Chicago, he was impressed by the mammoth working exhibit. There was plenty of talk about how good the new machine tools were, but too little demonstration in the buyer's terms of what they would do for him under his specific conditions to decrease losses, increase profits, and open up his new markets. It is doubtful whether the sales programs to be followed during the shows are designed as carefully as the equipment exhibited. Since relatively little equipment is actually sold during a show, subsequent contacts with each prospect should be thoroughly planned.

Don't forget that these shows will attract numberless top executives—persons who are not easily reached by our daily calls. A new horizon will arise for selling at all levels. Acceptance for improved equipment should suddenly grow. In thousands of instances interest will *germinate*. How these individual interests *terminate* will depend on the sales plans of the exhibitors and their future execution. It is important therefore, to evaluate sales performance.

There are three phases of planning that each sales manager should follow to meet this unusual opportunity:

1. Train each sales representative for his work. Provide facts to work with. Instill enthusiasm and sane showmanship. Coach men in meeting obstacles and objections. Train each in the efficient use of his time.

2. Lead and supervise the work of each sales engineer during the shows. Stress the importance of responding to every interest, and particularly of "buttoning up" future procedure—who to see, when to see him, and what data to be furnished. A record for future procedure will prove invaluable when the rush is over.

3. Develop a systematic plan for following up each interest and inquiry. Assign duties based on prospect, time, and problem. Here is where concentrated planning should take place for individual customers. Since certain top executives will attend the shows, the sales manager, himself, must assume a burden.

LATEST DEVELOPMENTS IN *Shop*

Giant "Shear-Speed" Shapers for Cutting Large Gears

Huge "Shear-Speed" shapers, said to be the largest machines of this type ever developed for cutting gears and toothed parts, have just been announced by the Michigan Tool Co., Detroit, Mich. These machines, designated Models 18136 and 18206, are designed for fast production of large gears (as well as for a variety of toothed parts, cams, and similar work). They will cut all teeth of a gear, or other external contours, simultaneously. Gears up to 20 inches in diameter and face widths up to 6 inches are within the work range of the machines. A gear 20 inches in diameter, of 3 diametral pitch, and with a face width of 6 inches, which previously required three hours to produce, can now be turned out on the large "Shear-Speed" machines in thirteen minutes.

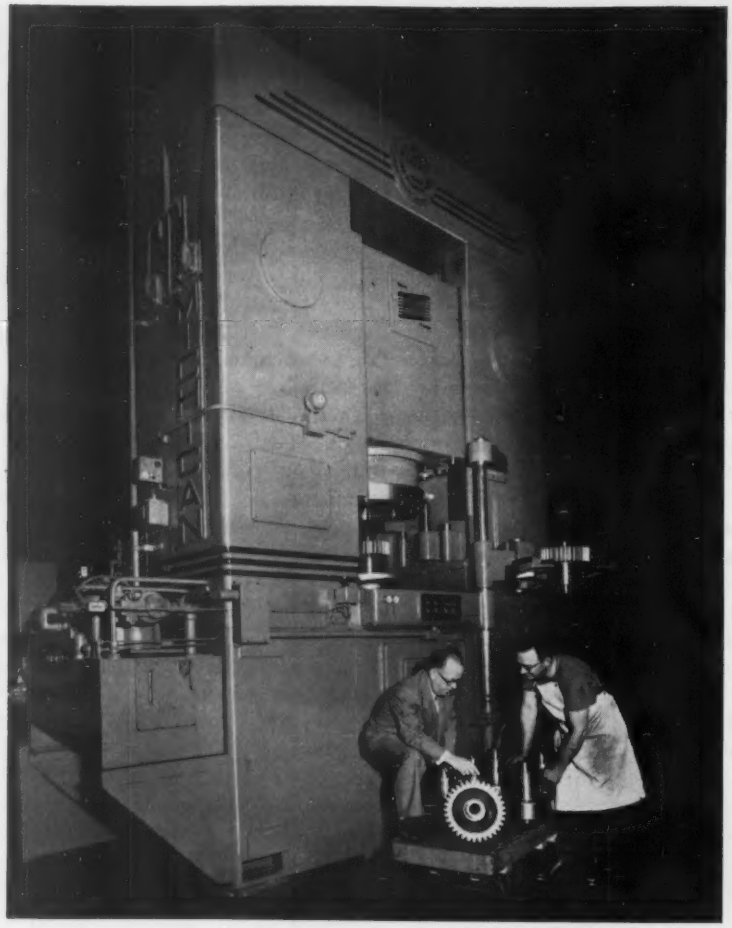


Fig. 1. Inspecting the first gears produced on the giant size "Shear-Speed" shaper brought out by the Michigan Tool Co.

Even though these machines weigh over 44 tons and are more than 17 feet high, they can be operated, set up, and maintained by one man. This is made possible by new features such as the automatic hydraulic positioning hoist used to swing the cutting head into position for mounting in the machine and to load and unload part blanks that weigh up to several hundred pounds. Another feature of importance on machines of this size is accessibility of the various components for maintenance. The hydraulic, electrical, and drive components are so located that they are either exposed or can be exposed in a matter of minutes for easy adjustment and maintenance.

Because of the high production rate and the size of the parts to be produced, a chip conveyor is built into the machines to carry away the chips. A large volume of coolant is provided to keep the cutting tools cool and to wash all chips away from the work fixture onto the conveyor as fast as they are produced.

Three automatic pressure lubricating systems maintain a continuous flow of oil to all moving parts. One network lubricates all the working components of the head, such as cams, shafts, and bearing surfaces; another keeps the two "Cone-Drive" gear sets in the drive section oiled; and a third system lubricates the moving components of the reciprocating work ram, including the connecting-rod,

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

wrist-pin, and bearings. A special detecting system with a warning bell notifies the operator if the vital ram section is not receiving the proper lubrication.

Either hydraulic or pneumatic automatic clamping fixtures can be used. Their operation is tied into the completely automatic machining cycle. Cutting heads are readily interchangeable to accommodate different part sizes and shapes. The stroke of the reciprocating work ram is adjustable to suit the face widths of the gears.

All critical surfaces of each cutting tool are ground to extremely close tolerances. Tools are form-relieved so that sharpening on an ordinary surface grinder maintains the accuracy of the form throughout the life of the tools. Guide areas on the tools and head components are made large, practically eliminating any inaccuracies resulting from wear.

Circle Item 101 on postcard, page 277

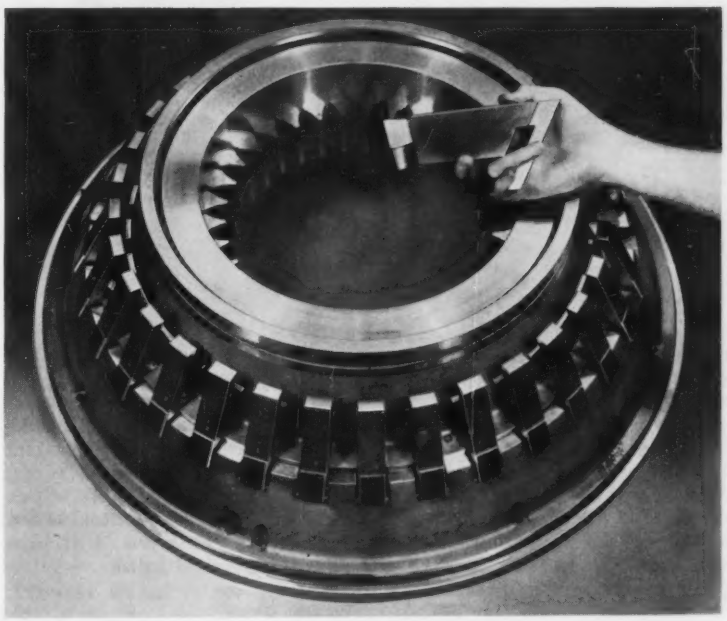
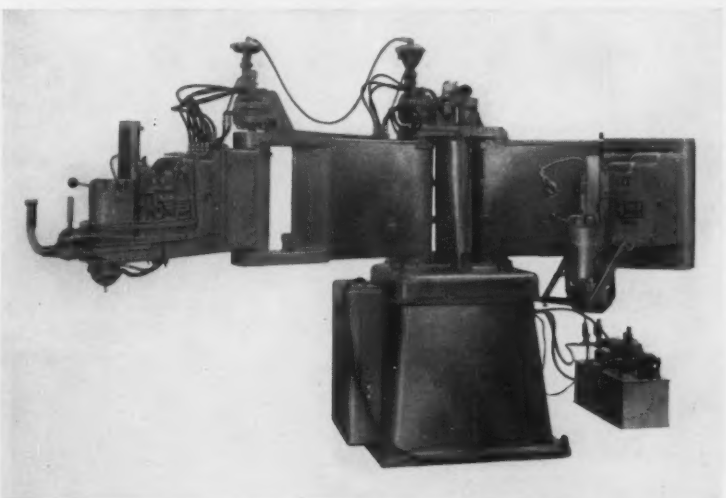


Fig. 2. Cutting head for the "Shear-Speed" shaper used to produce a thirty-three-tooth gear 12 1/2 inches in diameter

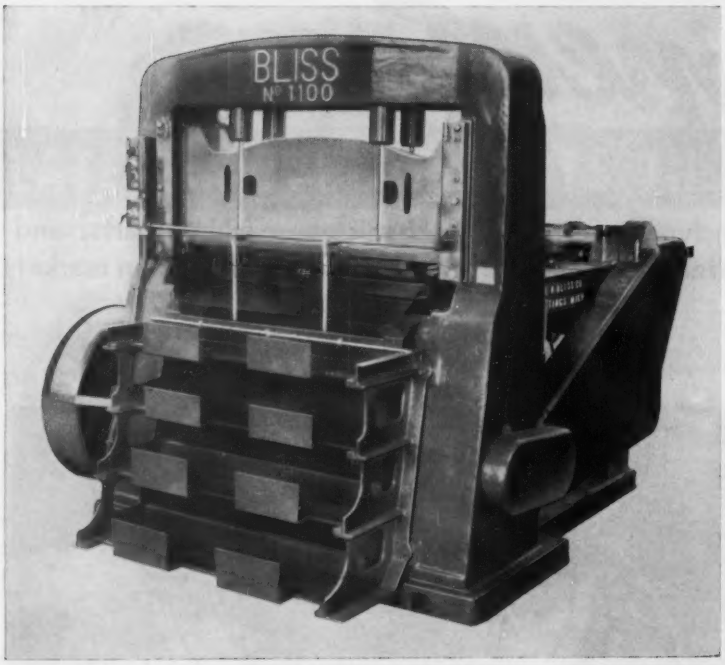
Onsrud Radial-Arm Router with "Power-Assist" Feed Mechanism

A power-feed mechanism, referred to as "power-assist," has been added to the radial-arm routers built by the Onsrud Machine Works, Inc., Chicago, Ill. The conventional radial-arm router has proved quite satisfactory for most machining operations on wood and non-ferrous metals when this material does not exceed 5/8 inch in thickness. However, when this thickness is exceeded the manual operation of the router becomes an arduous task; the cutter motor is overtaxed, and the operator overworked. Incorporation of the power-feed mechanism into the radial-arm routers has eliminated these difficulties.

The power-assist works on the



Onsrud radial-arm router equipped with power-assist feed mechanism

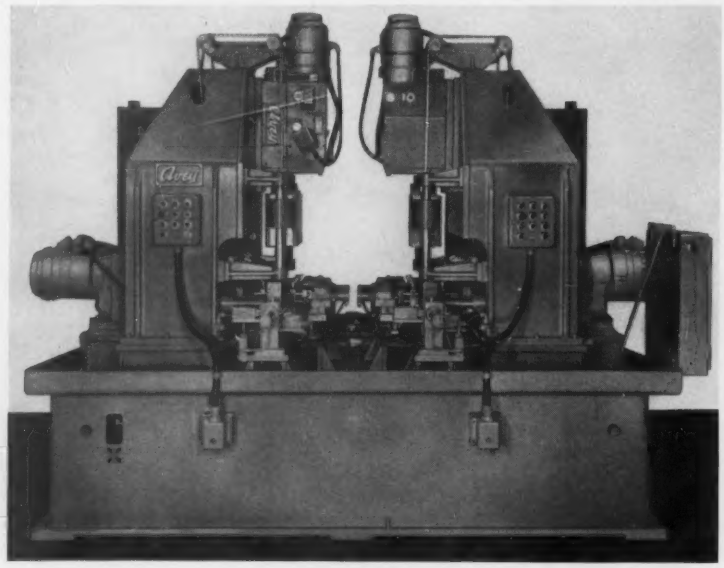


Scroll shear for blanking operations on wide sheets announced by E. W. Bliss Co.

principle of applying motivating power in the direction selected by the operator who merely moves the control lever in the direction he wishes the router to move, and the arm segments react at once.

The system incorporates hydraulic motors at each pivot point, actuated by a hydraulic valve which controls the rotation of the pivot shafts in the direction selected by the operator. The control always returns to the normal position as soon as the operator releases the lever. The operator, however, keeps the head in contact with the form bar at all times. This is the principal difference between a power-feed machine and a machine equipped with the power-assist mechanism.

Circle Item 102 on postcard, page 277



Line-O-Dex transfer machine brought out by Avey Drilling Machine Co.

Bliss Scroll Shear for Handling Large Sheets

The E. W. Bliss Co., Canton, Ohio, has announced a new scroll shear designed for the high-speed blanking of scroll strips for can ends, bottle caps and jar tops. The wide bed of this press handles sheets up to 36 inches square. Either automatic or hand precision feeding and trimming can be employed at high speeds. The press is equipped with magnetic or mechanical feed-bars and a new intake trimming slitter.

The heavy cast Meehanite frame is of one-piece design and the slide is counterbalanced and equipped with long guides. In addition to regular gibs, renewable wear strips are provided in the frame to serve as guides on the back of the slide.

Ample room is provided for new dies, which can easily be mounted in die sets with guide pins. The use of double and triple dies is also possible. Other design features include bronze-bushed connections; anti-friction bearings for slitter shafts; electric push-button controls; and air-actuated friction clutches. Automatic lubrication and the location of the operating mechanism below the table prevents the lubricant from dripping on or soiling the metal sheets.

Circle Item 103 on postcard, page 277

Avey Line-O-Dex Transfer Machine

A machine consisting of two transfer mechanisms, each of which is arranged with two No. 2 Avey cam-feed units, has been developed by the Avey Drilling Machine Co., Cincinnati, Ohio. Each cam-feed unit drives a three-spindle oil-circulating drill head, one from a vertical position and one from a horizontal position. Each half of the machine is arranged with a straight line set of transfer rails and a chute feed which drops one part at a time into the transfer rail.

The parts are advanced by a hydraulic indexing cylinder along the transfer rails, three at a time. After one group of three parts is indexed and clamped through automatic hydraulic fixtures, the drilling and the deburring cycle takes place, after which the three previously drilled parts are indexed to the ejection end of the trans-

fer mechanism. Each cam-feed unit is arranged with a hydraulically operated slide so that the units can be withdrawn to their rearward position in order to facilitate changing tools.

Operation of the machine is completely automatic, requiring only tool changing and chip removal. Three parts are drilled, burred and redrilled at double speed simultaneously on each half of the machine and may, if desired, be reburred. The loading operation is performed while machining operations are in progress.

A telephone stepping switch is used to control the sequence of these complex operations. Using special circuits developed to control this switch, it should produce millions of parts without requiring service other than lubrication. A spare switch, completely wired, is furnished for quick replacement.

Circle Item 104 on postcard, page 277

Cincinnati All-Steel Press Brake and All-Steel Shear

An all-steel press brake, Fig. 1, which can be used for shallow draw work and various types of press operations has been announced by the Cincinnati Shaper Co., Cincinnati, Ohio. This machine has a 36-inch wide bed, a ram with a shut height of 15 inches, an 8-foot die surface and a 5-inch stroke. Air cushions are mounted on the under side of the bed at both the front and back positions.

The machine weighs approximately 17 tons and is equipped with an air-electric clutch of the automatic-stop and non-repeat type. The two foot pedals are arranged to operate as one unit or separately. They have an interlocking feature that insures safety, especially in multiple press operations. Additional features include an air counterbalance and a special two-speed transmission which operates at thirteen and thirty strokes per minute.

The new 100 series Cincinnati all-steel shear, Fig. 2, is specifically designed for shearing corrugated metals. This particular shear is equipped for shearing corrugated railroad car end plates as well as regular flat plates. It weighs approximately 45 tons, will shear corrugated mild steel sheets 12 feet long, and operates at a speed of twenty strokes per minute.

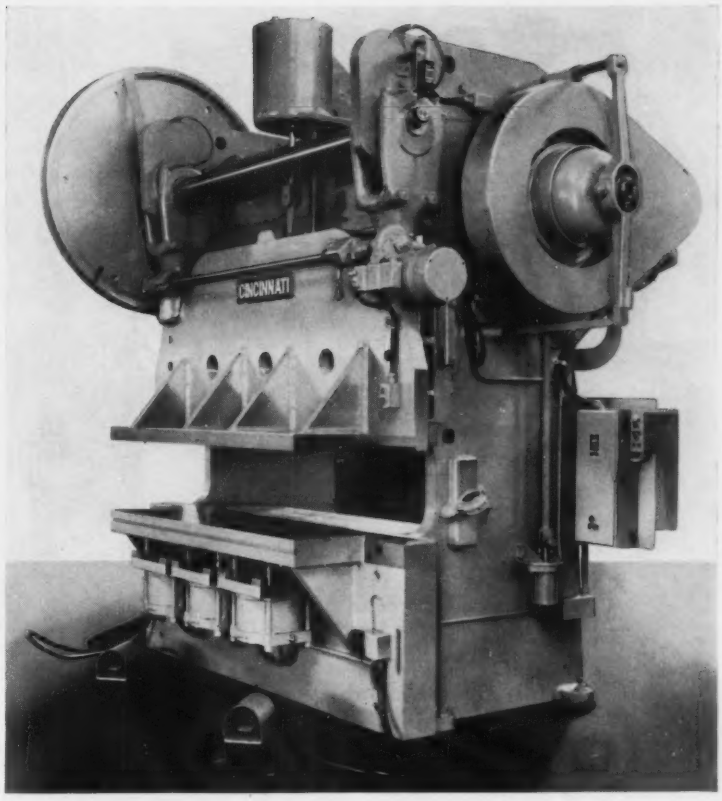


Fig. 1. Cincinnati all-steel press brake adapted for shallow draw work

The special table top of this shear is recessed to permit proper seating of corrugated stock. The thirteen hydraulic hold-down plungers are beveled at a 45-degree angle to allow clearance for the corrugations when shearing. Other features are a light-beam shearing gage, two T-slots in the front edge of the table, and a slitting adjustment for shearing longer sheets than the shear can accommodate in one operation.

Circle Item 105 on postcard, page 277

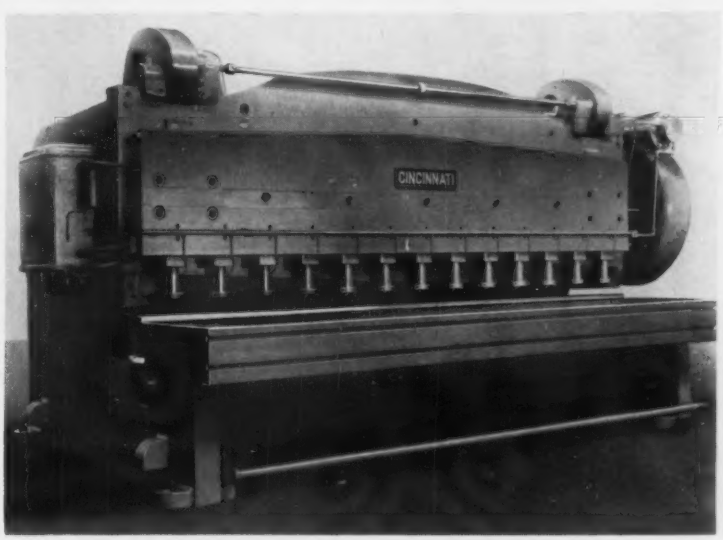
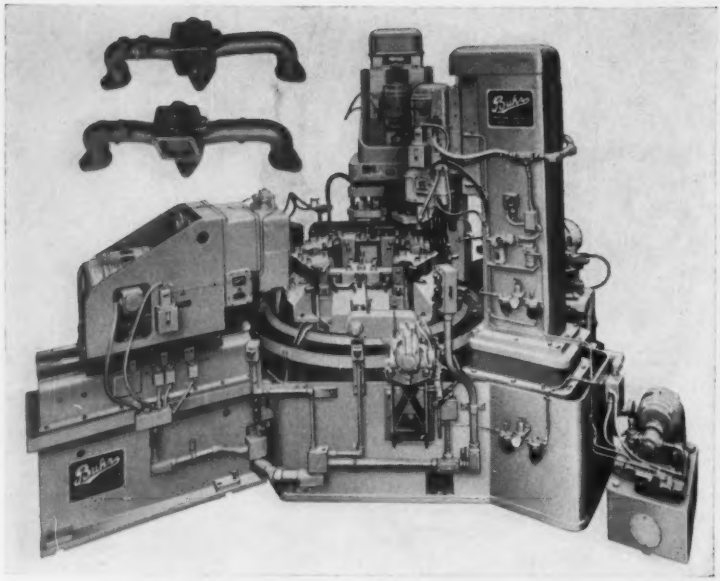


Fig. 2. Cincinnati all-steel shear designed for shearing corrugated metal



Special machine for processing intake manifolds built by the Buhr Machine Tool Co.

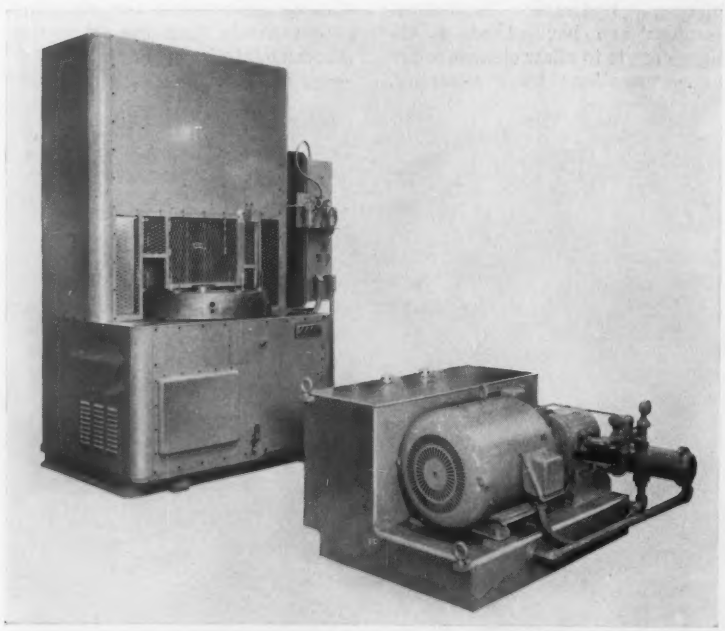
Buhr Special Dial Type Machine for Processing Intake Manifolds

Twenty-three operations are performed every eighteen seconds on automobile engine intake manifolds by a special machine built by the Buhr Machine Tool Co., Ann Arbor, Mich. This special five-way, dial type, hydraulic feed machine mills, drills, countersinks, and taps 206 intake manifolds an hour. Individual lead-screws guide the taps used for this work. The six-position automatic index-table is 60 inches in diameter and is equipped with a shot bolt. A feature of this machine is a rotating chip conveyor attached to the index-table which disposes of chips automatically.

The manifolds to be processed are loaded one per station, in each of the six single-place fixtures. The clamping mechanism is operated automatically by a power wrench equipped with torque control. Complete interchangeability of parts is obtained by the use of precision manufacturing methods. Exact alignment is assured by holding all parts to close tolerances and locating component assemblies by precision-bored holes with accurately fitted dowels.

All multiple heads are of ball bearing construction with precision-ground and hard chromium-plated threads; electrically controlled automatic indexing mechanism of the cam-and-roller type designed to insure uniform acceleration and deceleration of the indexing movement; hardened and ground laminated tool-steel ways; and hydraulic and electrical installations.

Circle Item 106 on postcard, page 277



Electric motor armature processing and assembling machine manufactured by Baker Brothers, Inc.

Press Designed to Process and Assemble Electric Motor Armatures

A press with an ultra-fast cycle which aligns and burnishes stacked laminations for electric motors in one operation and then centers and locks them on the shaft in a second operation has been built by Baker Brothers, Inc., Toledo, Ohio. The index-table of this machine has six stations. Its five-second cycle permits production at a rate approaching 600 parts an hour. Hydraulic pressure of 1000 pounds per square inch is provided by a separate pump. The index-table is electrically and mechanically controlled.

Motor laminations are stacked on the shaft when received at the machine. Three extra long fingers of the burnishing tool act as pilots and aligners and then follow through with eleven other fingers for the burnishing operation under a pressure of 10 tons. The work is then indexed to the second position where the laminations are positioned on the shaft under a pressure of 15 tons. The machine is self-lubricating and requires practically no attention for maintenance. Automatic gates safeguard the operator's hands.

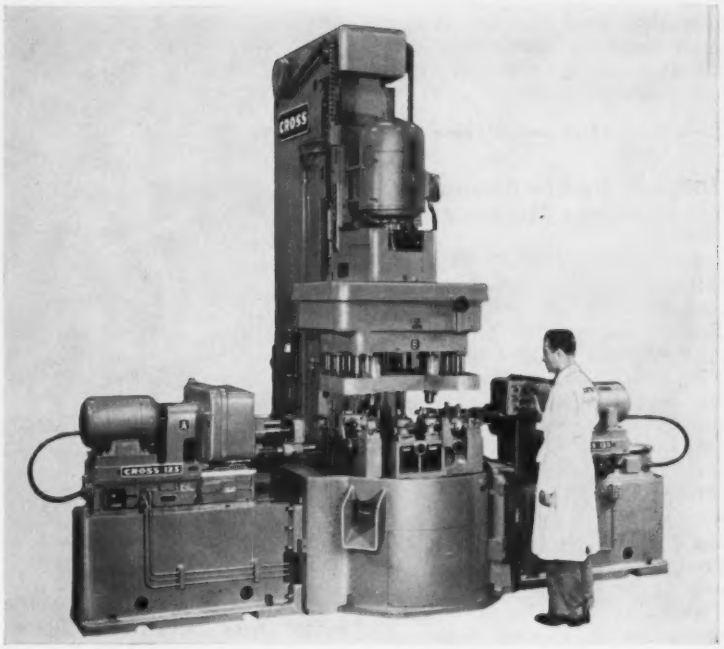
Circle Item 107 on postcard, page 277

Cross Dial Type Machine for Air Compressor Cylinder Blocks

Air compressor cylinder blocks are being drilled, chamfered, and reamed at the rate of 144 pieces per hour by a special machine tool developed by The Cross Company, Detroit, Mich. This machine is of the dial type and has four stations —one for loading and three for drilling, chamfering, and reaming.

The work cycle is automatic, a fluid motor being used to drive the dial-indexing mechanism. Two similar parts are handled by the machine through the use of a two-position, progressive type work-holding fixture. The standard and special parts of this machine are completely interchangeable. This feature facilitates maintenance and provides the flexibility needed to accommodate changes in the design of the work. Other features include hydraulic feed and rapid traverse, hardened and ground ways, and construction to J.I.C. standards.

Circle Item 108 on postcard, page 277



Special machine for processing compressor cylinder blocks developed by The Cross Company

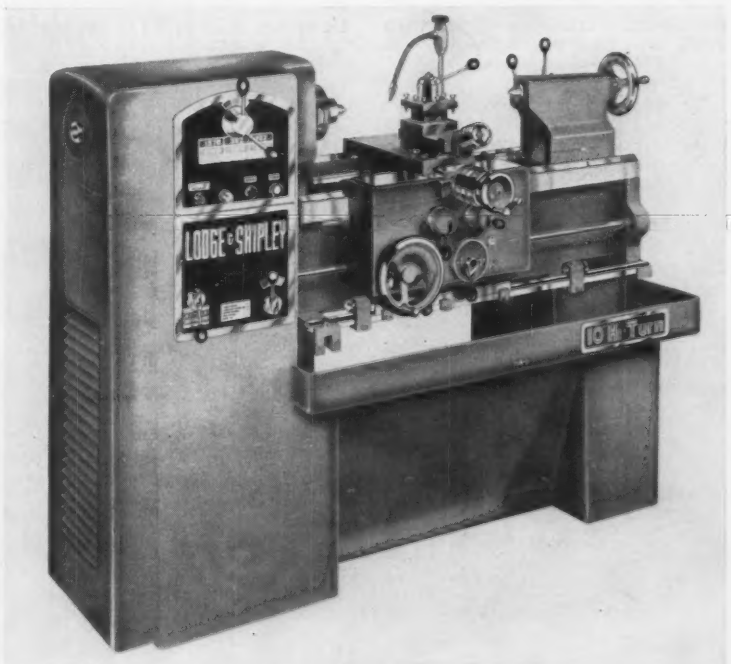
Lodge & Shipley "Hi-Turn" Production Lathe

A 10-inch lathe designed specifically for production operations, to offer speed and power and to sell at a low price, has been announced by the Lodge & Shipley Co., Cincinnati, Ohio. This lathe, known as the "Hi-Turn," is of new design. It has a 5-H.P. motor and a heavy-duty geared head. Spindle speeds range up to 3000 R.P.M.

As compared to conventional lathes, this machine incorporates many features normally considered optional. The lead-screw, rarely required for production operations, has been eliminated; a feature which had much to do with the low price of the lathe. A feed-rod is provided for use in turning, boring and facing operations.

Features include an all-new headstock with nine spindle speeds ranging from 202 to 3000 R.P.M. in the high range, 170 to 2500 R.P.M. in the intermediate range, and 136 to 2000 R.P.M. in the standard range; totally enclosed quick-change gear-box; a carriage and apron designed for accuracy and long life; an integral four-way tool-block with provision for rear tool-block and multiple tool operation; dual direct-reading micrometer cross-feed dials reading to 0.001 inch on the diameter; automatically operating template type length stops; and hardened and ground tailstock spindle.

The drive motor, with the dynamic brake, is in the machine leg. All spur gearing, built-in lubricating pump, filter and reservoir, and a built-in ammeter showing horsepower consumption are other features. The lever-operated totally enclosed quick-change gear-box provides nine feeds ranging from 0.0015 to 0.024 inch per



Low-cost, high-production lathe announced by Lodge & Shipley Co.

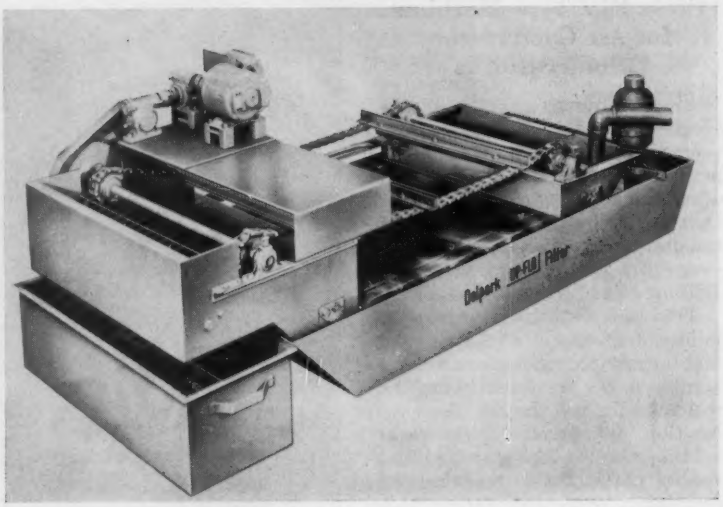
revolution. Feed selection is also color coded. A micrometer dial indicates carriage travel in 0.005-inch graduations.

Circle Item 109 on postcard, page 277

Delpark Up-Flo Automatic Filtering Machine

An automatic, self-cleaning machine which filters fine as well as coarse particles from liquids through a permanent filter medium is announced by the Industrial Filtration Co., Lebanon, Ind. This Delpark Up-Flo filter utilizes gravity to remove the heavier solids before filtration of the liquid through a horizontal bar type screen. Only the fine particles held in suspension reach the filtering screen. The efficiency of the process is never impaired by the deposits.

Chain-driven flights or scrapers, operating on a time lapse sequence, pass under the filter and remove deposits from the under side of the screen and the area beneath the screen. These flights carry the particles to a cleaning device from which the filtered swarf drops into a tote box for disposal. This filtering machine is made in a wide range of sizes.



Delpark automatic filtering machine announced by the Industrial Filtration Co.

Circle Item 110 on postcard, page 277

Special Hinge Drilling and Reaming Machine

The Michigan Drill Head Co., Detroit, Mich., has built a special machine which drills and reams 700 automobile door hinges per hour. This machine is of the double-end, trunnion type with hydraulic feed. The feed-unit ways are hardened, ground, and automatically lubricated. Coolant is provided for the spindles, and electrical and hydraulic installations are built to J.I.C. standards. All drill and reaming heads are of the pot type, equipped with ball bearings. Drilling spindles are axially adjusted and equipped with chip breakers.

This is a four-place, four-station machine with power-operated trunnion type fixtures. The part locating and clamping blocks are interchangeable and will handle any size hinge. The fixtures are also arranged so that finished parts are automatically ejected after the machining cycle prior to reloading.

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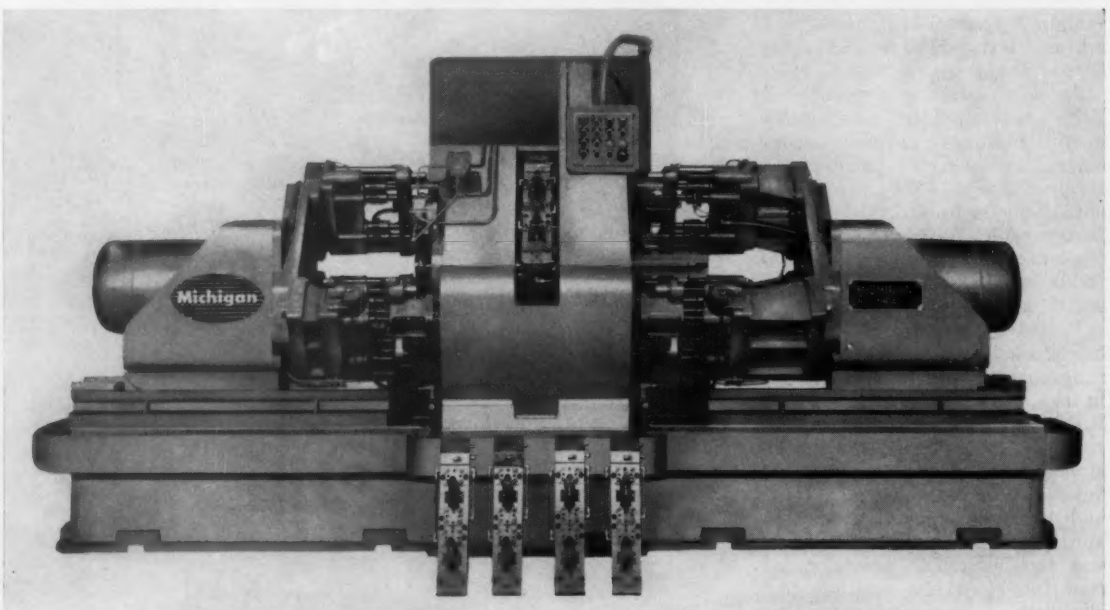


Automobile door-hinge drilling and reaming machine built by the Michigan Drill Head Co.

Portable Hydraulic Testing Machine

A portable hydraulic tension and compression testing machine, having a capacity of 60,000 pounds, has been developed by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. This machine is designed to meet the requirements of the Argonne National Laboratory, and is known as the Model 60-A Baldwin-Tate-Emery universal portable testing machine.

A feature of this machine is its ability to apply both tension and compression in a common testing space over a fixed table located 24 inches above the floor. A double-acting Emery hydraulic capsule is used in the weighing system which is separate and independent of the hydraulic loading system. The 60-A testing machine can be operated as far as 25 feet from a stationary control console. The hydraulic and electric connecting lines have "quick-disconnect" couplings.

The machine has a clear space of 23 1/4 inches between columns and a 20- by 20-inch table. The opening for tension tests is 34 inches, not including the stroke space. Head motion can be controlled between 0.05 inch and 15 inches per minute at any load up to 60,000 pounds. Accuracy of the load indications is held within 0.5 per cent of the load or 0.1 per cent of the scale range.

Circle Item 112 on postcard, page 277

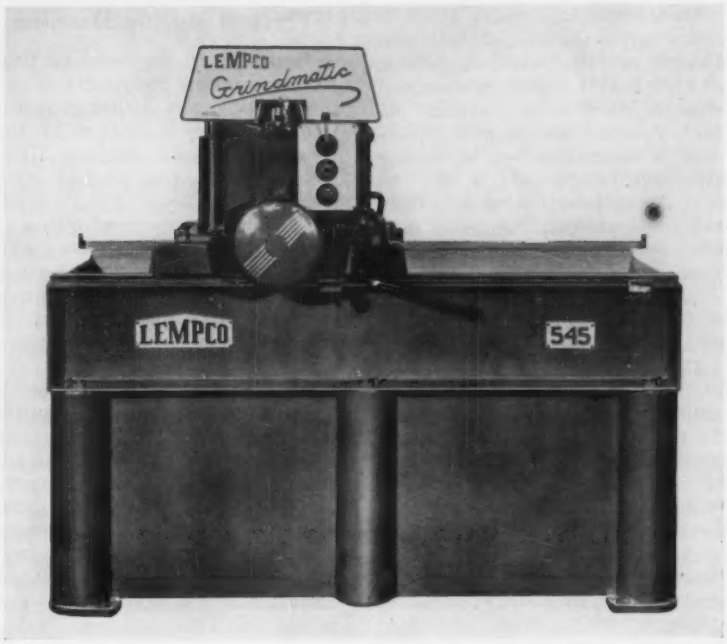
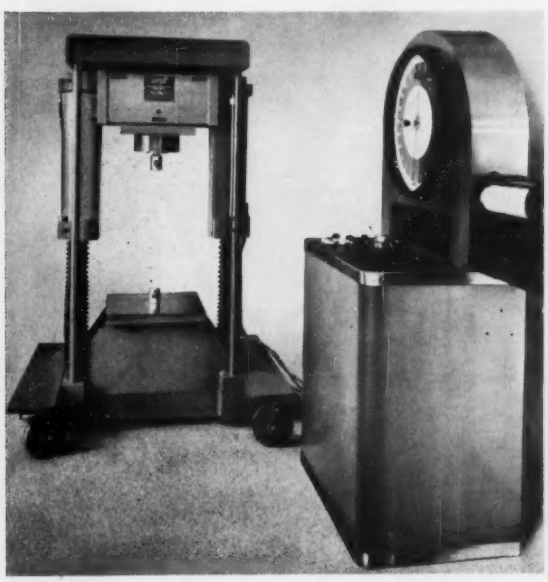


Fig. 1. "Grindmatic" automatic surface grinder

Lempco Automatic Surface Grinder Equipped for Wet Grinding

A Model 545 "Grindmatic" automatic surface grinder has been announced by Lempco Industrial, Inc., Bedford, Ohio. This machine is compactly designed and has conveniently grouped controls. Work can be secured by means of conventional industrial holding fixtures, or by the use of a magnetic chuck offered as optional equipment. The design provides maximum work visibility at all times, allowing inspection for finish and accuracy without the necessity of removing the workpiece from the machine or disturbing the grinding cycle. All backlash is eliminated in the feed mechanism of the grinding wheel by a pneumatic counterbalance.



Baldwin-Tate-Emery universal portable testing machine

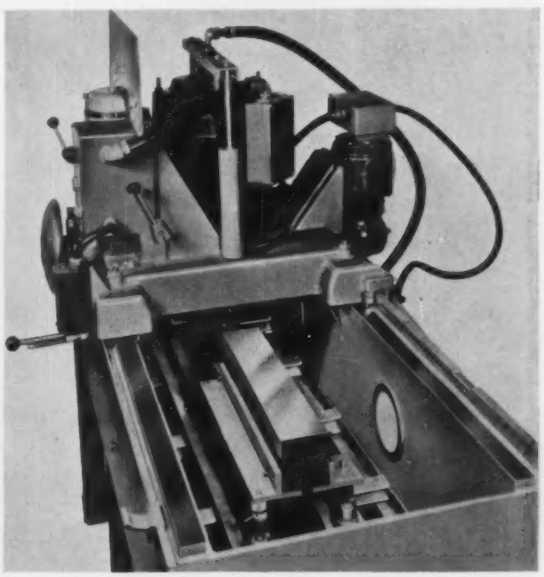


Fig. 2. Close-up of surface grinding machine in Fig. 1

On the standard model, a 3-H.P. motor drives the wheel-spindle and 12-inch grinding wheel at a speed of 1140 R.P.M. The traverse speed rate is fixed at a constant 45 inches per minute. Length of traverse is controlled by adjustable reversing stops which can be easily and quickly changed. Once the stops are set, the travel over the work is automatic. Flame-hardened and ground ways are used to insure lasting precision.

Ample coolant flow is provided by a large-capacity pump and a 50-gallon reservoir with a sloping, easily drained sump. The machine handles work 38 inches long, 11 1/2 inches wide, with a maximum height of 11 inches. The bed is 71 inches long by 20 inches wide. The grinder has an over-all height of 65 inches, a depth of 39 inches, and a length of 74 inches. The wheel is 12 inches in diameter and is driven by a 3-H.P. motor. A 1/2-H.P. motor drives the feed mechanisms. To meet special requirements, the machine can be furnished with motors and wheels of different sizes.

Circle Item 113 on postcard, page 277

Vertical Milling Machine

An improved Super 55 vertical milling machine designed for boring, milling and drilling operations has been announced by the Index Machine Co., Jackson, Mich. This machine can be had with either a 1 1/2- or 2-H.P. head, the heavy-duty motor affording at least 50 per cent more power than previously available. The increase in power and the dynamically balanced cast-iron pulleys and drive system make possible a much higher production capacity.

An improved system of gibs allows the table clamping mechanism to be brought to the front side of the saddle and still retain the advantage of having the rod trays adjacent to the fixed table slideway. A newly designed spindle brake is also said to increase production. The heavier ribbed column and the heavier knee and saddle are additional outstanding features.

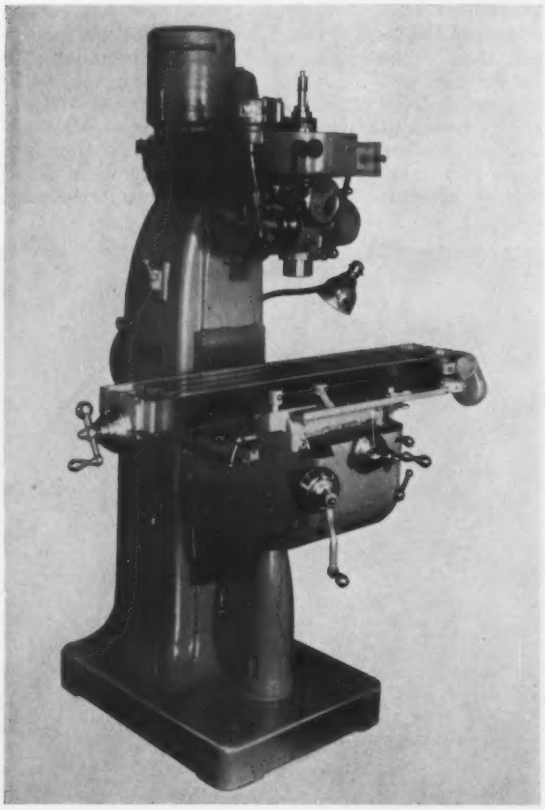
The machine has the capacity for operating 1/8- to 1 1/2-inch end-mills in tool steel and 2-inch or larger mills in milder steels or cast iron. Table sizes are 40 by 9 inches or 46 by 9 inches. The height of the machine over-all is 76 inches.

Circle Item 114 on postcard, page 277

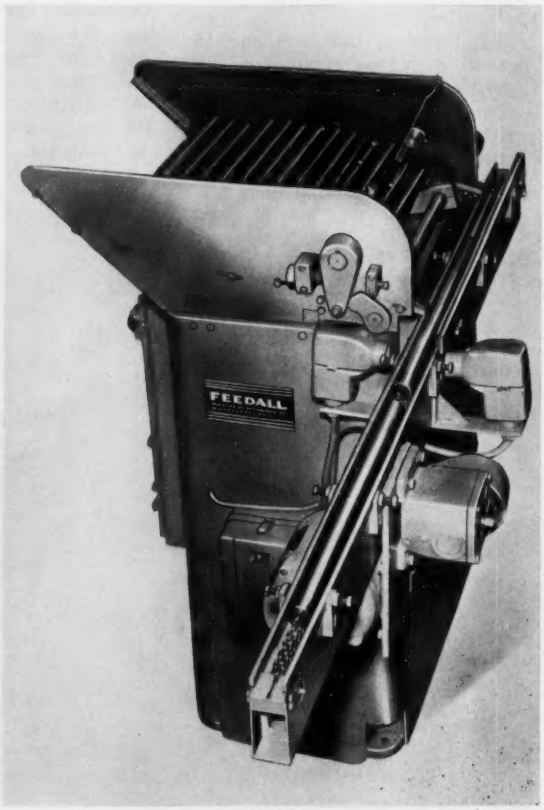
Feedall Automatic Bar-Stock Feeder

Feedall, Inc., Willoughby, Ohio, is placing on the market a bar-stock feeder, Model 1700 B, designed to automatically feed bars and tubes to centerless grinders, polishing machines, heat-treating and hardening equipment, and other processing units. The model illustrated will convey parts from the hopper to the machine. It will handle parts or bars from 1/4 inch to 1 1/2 inches in diameter and from 6 to 26 inches in length at any desired constant speed within the range of 5 to 20 feet per minute. Other models are available for feeding parts up to 60 inches in length and at various rates of feed. Cycling of this feeder can be controlled by either a photoelectric relay or mercury switch.

Circle Item 115 on postcard, page 277



Vertical milling machine made by the Index Machine Co.



Automatic bar-stock feeder brought out by Feedall, Inc.

Acousti-Room for Audiometric Testing

A portable Acousti-Room for audiometric testing has been developed by the Architectural Products Division, Burgess-Manning Co., Chicago, Ill., to facilitate hearing tests which are becoming more and more common as a result of the growing recognition of the industrial noise problem. This portable room, 7 feet high, 4 feet wide, and 7 feet deep has built-in high-capacity sound absorption features and forced mechanical ventilation. The interior is equipped with a plastic top desk and a wall outlet for testing apparatus. The floor is covered with a wall-to-wall carpet.

An 18- by 24-inch observation window eliminates any closed-in feeling on the part of the person being tested. The unit is shipped knocked-down, and can be erected in three or four hours by two competent maintenance men. It can house patient, observer, and technician in comfort, and can be moved like furniture as required.

Circle Item 116 on postcard, page 277

Broaching and Centering Machine for Automotive Rear Axle

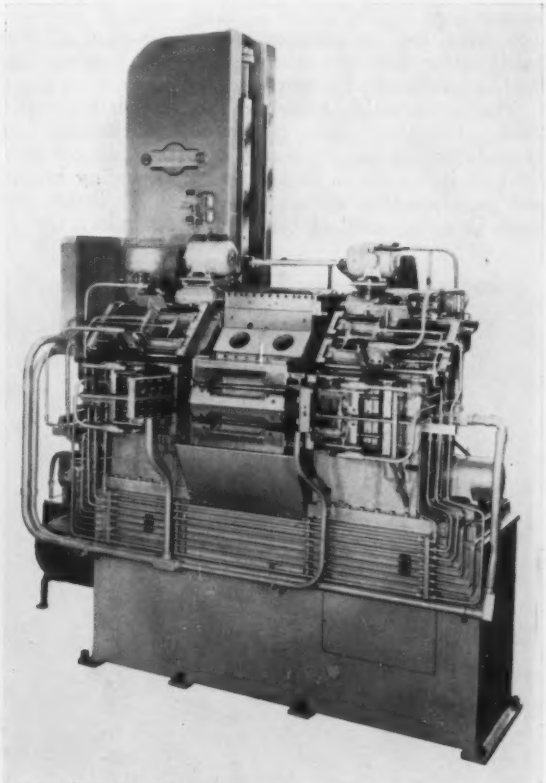
A broaching and centering machine, brought out by American Broach Machine Co., Ann Arbor, Mich., broaches the end of an automotive rear axle to length and then centers the broached surface. The machine has four two-station fixtures equally spaced on an indexing trunnion which operates on an eight-position index arrangement.

Two parts are unloaded and two parts are loaded by the operator at the front of the machine as the fixtures rotate past the loading position. In simultaneous operation, two parts are surface-broached at the back station while two parts are center-drilled at the top station. The operator pushes buttons after loading to start the machine cycle. The parts are automatically clamped in place and indexed 45 degrees to an intermediate station. This allows the broached parts to swing clear at the back broaching station so that the broach can be returned to the starting position. Parts previously drilled at the top station are also unclamped as they rotate down to an intermediate station. When the broach has returned to the starting position, the trunnion indexes another 45 degrees to present two parts for broaching, two for drilling and two for unloading. The operator then reloads and pushes buttons which cause the cycle to be repeated.

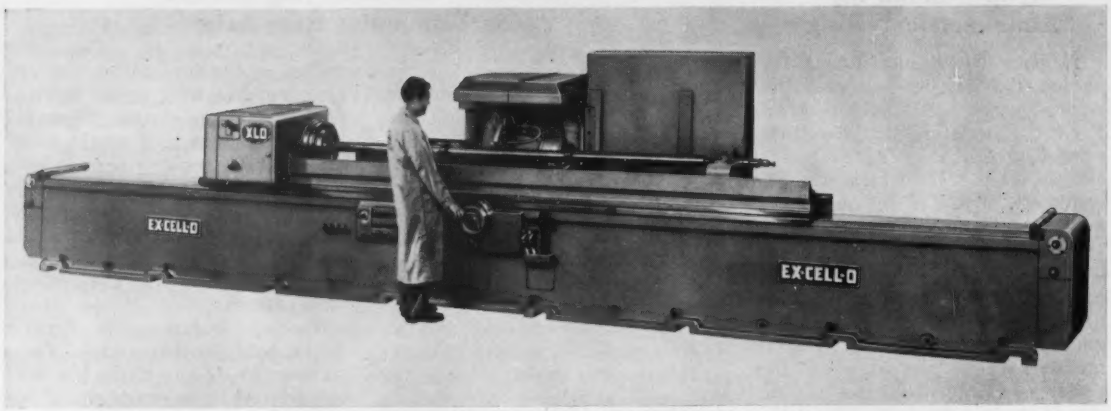
Tooling includes the fixtures which hold two parts each. These fixtures locate and clamp the work at each end by means of equalizing jaws. The clamping and unclamping is accomplished mechanically with a wedge-operated action, actuated by hydraulic cylinders. The centering unit consists of two two-spindle units mounted on top of the trunnion support on either side of the fixture, and electrically interlocked to the cycle. Parts are broached by surface broaches, with the broach and holder assembly mounted on the vertical machine slide.

Circle Item 117 on postcard, page 277

Burgess-Manning Acousti-Room for audiometric testing to facilitate hearing tests



Rear axle broaching and centering machine built by American Broach & Machine Co.



Thread-grinding machine for producing long precision threads built by the Ex-Cell-O Corporation

Ex-Cell-O Thread-Grinding Machine

In response to the demand for a machine to grind long threads on such parts as aircraft actuator screws and machine tool lead-screws, the Ex-Cell-O Corporation, Detroit, Mich., has developed a large thread grinder. Several of these machines are already being used to grind ball-race screws wherein anti-friction balls circulate between the nut and the screw. This type of screw is finding wide use in moving heavy loads under accurate control and with a minimum of power.

The new machine, known as the Style 120 Ex-Cell-O precision thread grinder, will grind a thread 10 feet in length in one setting; will accommodate work up to 12 feet long between centers; and will hold close tolerances on form, pitch diameter, and lead. Work-pieces longer than 12 feet can be inserted through the work-spindle, and threads longer than 10 feet can be ground one section at a time, or by turning the work end for end. The lead at adjacent sections can be picked up and continued accurately.

Automatic features of this thread grinder include feed to finish size, grinding wheel dressing, resumption of the grinding cycle after dressing, backlash compensation, control of coolant flow, lubrication, and retraction of the grinding wheel at the end of the grinding cycle.

To insure precision in this long grinder, the work-table is completely supported for the full length of its travel range. Anti-friction rollers under the table provide for easy movement, which also contributes to accuracy.

Circle Item 118 on postcard, page 277

Federal electronic gage for inspecting and sorting piston-pins

Federal Piston-Pin Gage

The Federal Products Corporation, Providence, R. I., has announced a completely automatic, multiple-action electronic sorting gage which measures the hardness, over-all length, triangular out-of-roundness, outside diameter and taper of automotive piston-pins. In addition, it sorts the pins into ten size categories, including four outside diameter groupings varying by increments of 0.0001 inch and the over size and under size rejects. Its gaging and sorting speed is more than 4000 work-pieces per hour.

The gage is designed either for conveyor or manual feed and discharge. From the magazine feed-chute the piston-pins roll into a four-cup index-wheel where they are carried to the hardness-testing station. There they are checked by a rebounding hammer in a marked scleroscope tube. Rejects pass out of the gage at the rear. At this station the work-pieces are also measured by a Federal Electricator for over-all length. Reject signals set a mechanical "memory" device for later disposal.

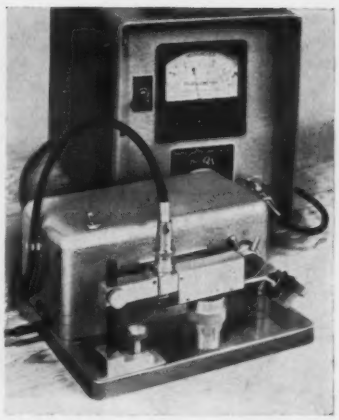
Next, the work-piece rolls into a chain conveyor which carries it to the out-of-round gaging station where it is rotated approximately 120 degrees and its high and low readings are noted. If the difference between these two readings

is greater than the tolerance allowed, the work-piece is judged "bad" and earmarked for later disposal.

At the following station the outside diameter of the work-piece is measured and the "memory" device is set for later sorting into one of the four diameter groupings, plus the over and under size rejects. At the final gaging station the taper is measured, using the diameter gaging unit for a reference position. If the taper is greater than the tolerance allows, the work-piece is later sorted into the taper reject chute.

Electrical operation of the five gaging stations and all recycling is controlled automatically by switches actuated by timing cams.

Circle Item 119 on postcard, page 277



Profilometer for checking small parts

"Rotary Pilotor" for Checking Surface Roughness

The Micrometrical Mfg. Co., Ann Arbor, Mich., has announced a Type RE "Rotary Pilotor" for taking Profilometer roughness measurements around surfaces of rotation on small parts. Surfaces having a radius of from 1/32 inch to 2 inches or more can be readily measured on a production basis. Tracers can be furnished to reach surfaces in parts of almost any shape.

An adapter locates the center of rotation of the work surface on the axis of the spindle; and the work surface moves past the point of a stationary tracer at a speed of 0.1 inch per second, driven by belt from a gear-motor in the

Hydraulic Plate Edge Planing Machine

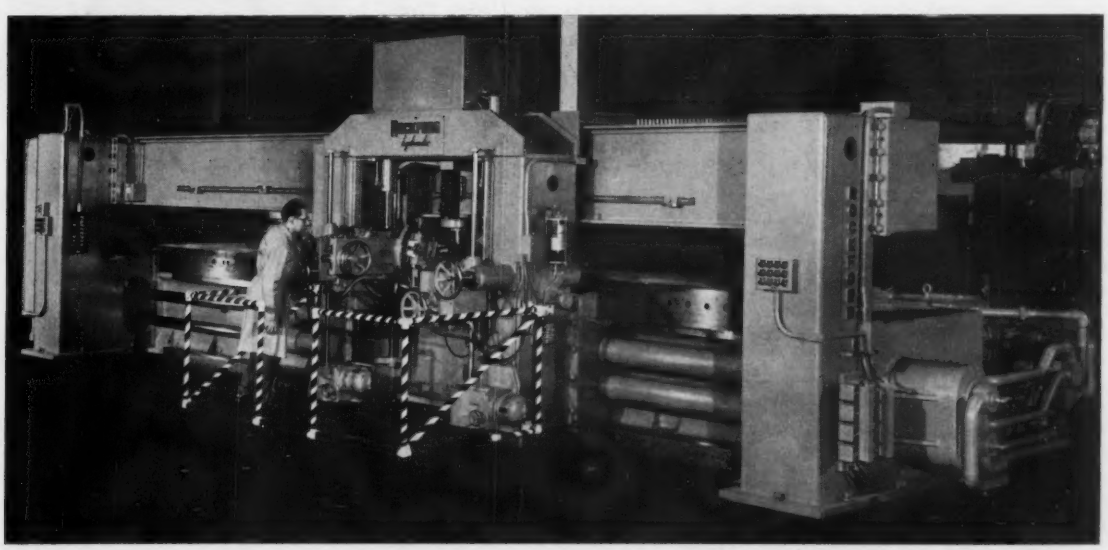
A large hydraulic plate edge planer of improved design has been announced by the Rockford Machine Tool Co., Rockford, Ill. This machine will handle work 14 feet wide by 7 inches thick. It has a long over-arm containing eight hydraulic cylinders which operate four work-clamping shoes.

The saddle of this planer reciprocates at a speed ranging from 10 to 200 feet per minute, and the cutting speeds are infinitely adjustable. The saddle carries a right- and left-hand side-head rail on which are mounted the two side-heads that carry the cutting tools. Mounted on the back of the saddle are two heavy-duty double-end hydraulic cylinders. The entire saddle assembly, and the two cylinders, move back and forth while the cylinder rods remain stationary with the bed and columns. Most saddle movements and all head movements can be controlled from the stationary pendent or from a movable pendent on the platform of the saddle. Both side-head rails of the saddle are equipped with handwheel-operated work locators.

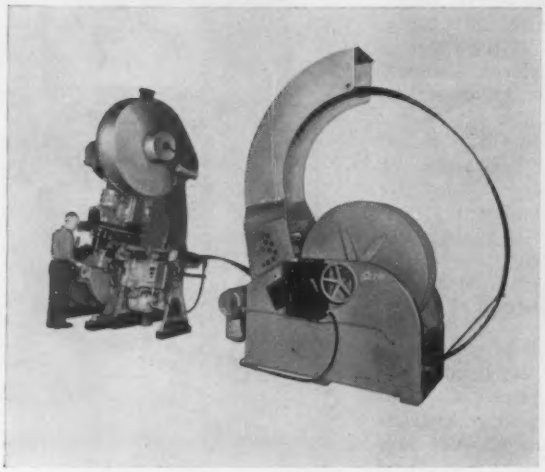
The two side-heads are hydraulically counterbalanced and each has a hydraulic tool-lifter. Feed for each head is hydraulically controlled and electric rapid traverse is available in any direction. All feed and traverse movements for either head can be selected, engaged, or disengaged by push-button control from either pendent station. Speed adjustments can be made by means of a direct-reading tachometer and push-buttons.

The hydraulic system for the saddle is a complete unit including motor, pump, and the necessary valves to operate the side-heads, even while the saddle is traveling at its maximum speed of 200 feet per minute. The hydraulic system for the saddle is made ready for operation by simply connecting it with an electrical power source, and is entirely separate from the main hydraulic drive unit.

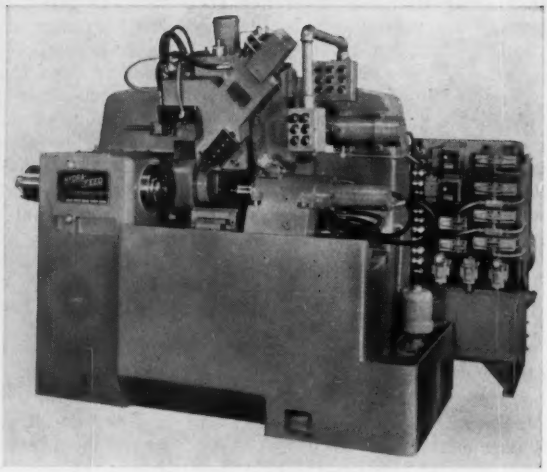
Circle Item 120 on postcard, page 277



Hydraulic plate edge planing machine built by the Rockford Machine Tool Co.



Coiled stock cradle and straightener made by Special Equipment & Sales Co.



High-production tracer lathe brought out by the Hydra-Feed Machine Tool Corporation.

Pilotor housing. Change pulleys can be furnished to provide the same tracing speed for surfaces of different radius. Settings for reciprocating rotation through any desired arc from 10 to 350 degrees are made by two adjustment rings on the spindle, which are clamped in place by thumb-screws. By leaving both thumb-screws loose, continuous rotation is obtained.

Circle Item 121 on postcard, page 277

Cradle and Straightener for Coiled Stock

A combination cradle and straightener with a reverse loop feature, designed to save floor space in the press room, has been announced by the Special Equipment & Sales Co., Hazel Park, Mich. Floor space is saved by directing the loop of stock over the coil, by means of an upright stock guide; and, under the coil, by means of an internal stock guide. By eliminating the customary and lengthy loop, between the cradle and the feeding mechanism, this equipment saves up to 72 square feet of floor space.

This "Sesco" coil-stock cradle with built-in power straightener is of rugged construction, yet, simple in design. The coil stock is carried on two large-diameter, smooth-finished, powered rollers, that are mounted in self-aligning ball bearing pillow blocks. Heavy slat conveyors for carrying the coil are available, if required.

The coil stock can be loaded by overhead crane or fork lift-truck, through the open end of the cradle. Where ramp loading is employed, an air-operated shock absorber is recommended to absorb the coil weight in loading. The built-in straightener will accommodate all stock up to 3/16 inch in thickness. All rolls are hardened and ground. Except for adjustable straightening rolls, each set of rolls is power driven. The straightener consists of two sets of pinch rolls and five straightening rolls. Models with a greater or smaller number of straightening rolls are available. A 4-to-1 speed ratio drive motor provides a wide range of operating speeds.

Circle Item 122 on postcard, page 277

Compact Power Units for H-P-M Fast-Acting C-Presses

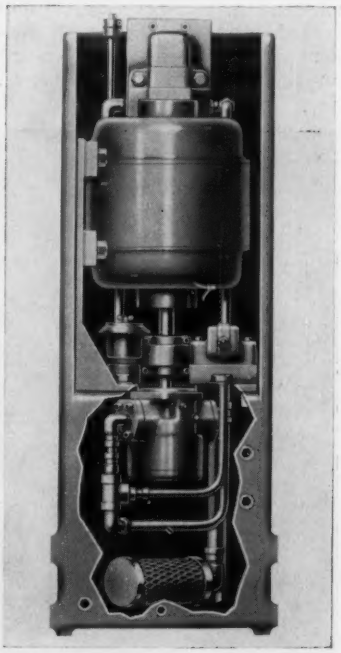
Small, fast-acting C-presses made by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, for a wide range of small press work are now being equipped with compact power units. The pump and motor of the units are vertically mounted on a common plate that serves also as the cover for the hydraulic oil reservoir. The pressure-control valve is also panel mounted on this cover so that the entire assembly can be installed or removed as a unit.

Panel-mounted valves simplify maintenance by reducing the number of pipe and tube connections to a minimum. More efficient operation is claimed for a wide range of work performed by presses in the 2- to 200-ton class when using the new power units.

Circle Item 123 on postcard, page 277

High-Production Copying Lathe

A tracer lathe designed for versatility, ruggedness, and high production has been announced by Hydra-Feed Machine Tool Corporation, Ferndale, Mich. This HD-8 tracer lathe has been developed to permit the turning of complex shapes with the minimum chance for human error. It is also built to have the rigidity and power necessary for taking sizable cuts.



Compact power unit for C-presses made by Hydraulic Press Mfg. Co.

Location of the tracer slide on the top carriage is said to lessen the possibility of chips and dirt getting on the slide and interfering with efficient operation. The unobstructed front of the machine facilitates loading, unloading and checking of the work.

Machines can be supplied with a constant- or a variable-speed drive for the spindle. An auxiliary rear carriage for facing, grooving, chamfering or any other type of cut that can be handled by a straight-plunge operation is also available.

Either flat or round templates can be used with the lathe. Templates of any shape can be quickly fastened in place to insure accurate duplication of work.

Circle Item 124 on postcard, page 277

Wallace Hydraulic Joist and Stirrup Bender

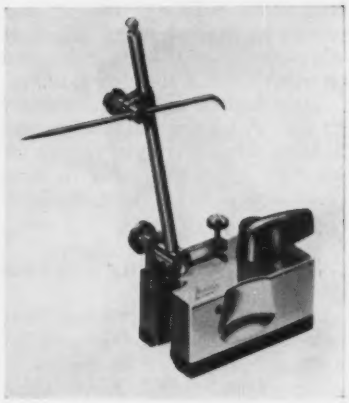
A No. 35 hydraulic bender, designed primarily for bending the web in steel joists used to support floors and roofs in building construction and for bending stirrups employed for reinforcements in concrete columns, has been announced by the Wallace Supplies Mfg. Co., Chicago, Ill. The machine has the capacity for bending two round bars 13/16 inch in diameter and three 3/4-inch round bars. The bender drive operates under full power both clockwise and counter-clockwise. It is controlled by two hydraulic foot valves so that the operator has full use of his hands for positioning the work prior to bending. The bending operation is simple, it being unnecessary to turn the bars when progressing from one bend to the following one.

For changes in bar size or for changes in radii on the same size bar, it is usually necessary to have additional dies. These dies are made of hardened steel for maximum resistance to wear. The hydraulic pump is driven by a 5-H.P. motor. The head rotates at 13 to 15 R.P.M. and will make a bend to one-half the bar diameter. The floor space required for the bender, without allowance for swing movements, is about 58 by 39 inches.

Circle Item 125 on postcard, page 277

Lufkin Magnetic-Base Surface Gage

A surface gage, with a magnetic base of new design, has been added to the line of "Miti-Mite" tools manufactured by the Lufkin Rule Co., Saginaw, Mich. The permanent magnets in the base of this gage are controlled by an off-on switch. This permits easy positioning, and positive holding after the gage is in position. Placing the switch in the partial off position reduces the amount of magnetic pull so that slight changes can be made in the location of the gage. The base is precision-machined and ground and can be used on a marble surface plate.



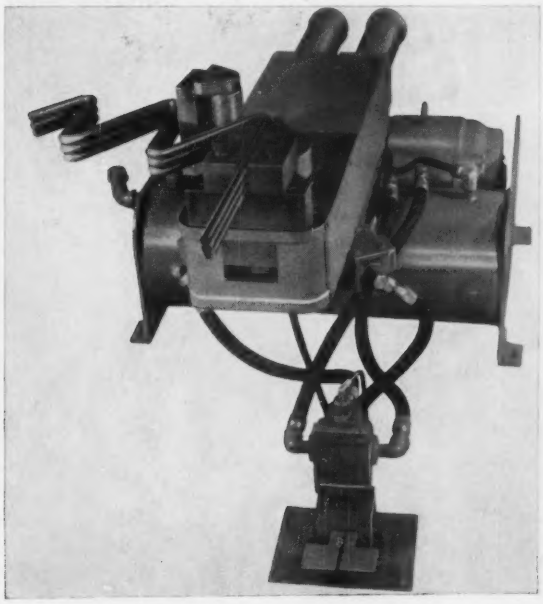
Lufkin magnetic-base surface gage

The surface gage has all the features of a universal surface gage, including fine adjustment, full 200-degree swing of the spindle, and both 4- and 7-inch spindles.

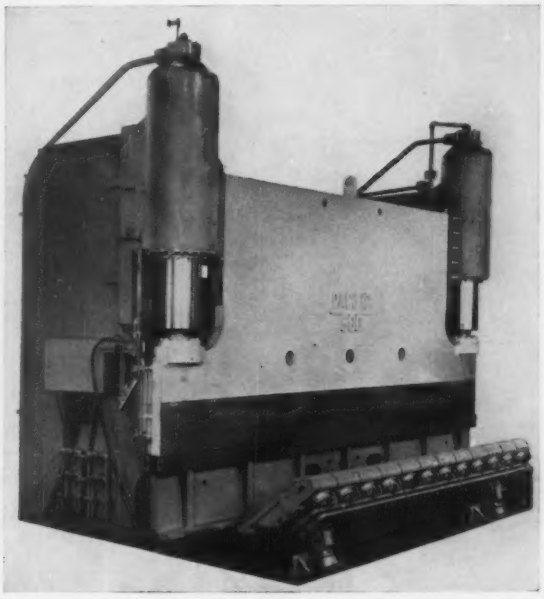
Circle Item 126 on postcard, page 277

Hydraulic Stretch-Forming Press

A new hydraulic stretch-forming press which has an over-all length of 16 feet and stretch jaws 12 feet long is being built by the Pacific Industrial Mfg. Co., Oak-



Hydraulic power bender made by Wallace Supplies Mfg. Co.



Stretch-forming press built by Pacific Industrial Mfg. Co.

land, Calif. This press is employed to form leading edges of wings for aircraft and can be used on other stretch-forming jobs.

Stretch-forming is accomplished by stretching the material around a male die. A single plastic or Kirksite die can be used to form complex shapes. A simple pistol-grip control operates all press and stretch-forming equipment. By simply removing the stretch-forming equipment the machine is converted into a versatile press brake with a maximum capacity of 500 tons, a stroke of 63 inches, and an open height of 48 inches.

Circle Item 127 on postcard, page 277

Special Red Ring Internal Helical Gear-Tooth Grinder

A special gear grinder that grinds the internal helical teeth on a ring gear about 18 inches in diameter and only 1/2 inch thick has been developed by the National Broach & Machine Co., Detroit, Mich. This machine is basically a Red Ring Model SGF-18-inch external helical gear-tooth grinder modified to meet the special requirements of the internal helical gear. To grind the internal gear teeth, the wheel-spindle is swung to an angular setting corresponding to the helix angle. The top of the wheel contacts the work.

A special "upside-down" dresser attachment, which dresses the top surface of the grinding wheel, has templates for dressing each side separately. A heavy-duty tailstock supports the work-holding arbor.

When the gear is positioned for grinding, the wheel is dressed and the internal gear teeth are then ground one space at a time, the gear being indexed to bring each successive tooth space into the grinding position. A helical guide bar rotates the gear in correct relation to the table reciprocation movement during the grinding of each tooth space. The internal helical gear that is ground by the special grinder illustrated has eight-pitch teeth and a helix angle of nearly 40 degrees.

Circle Item 128 on postcard, page 277

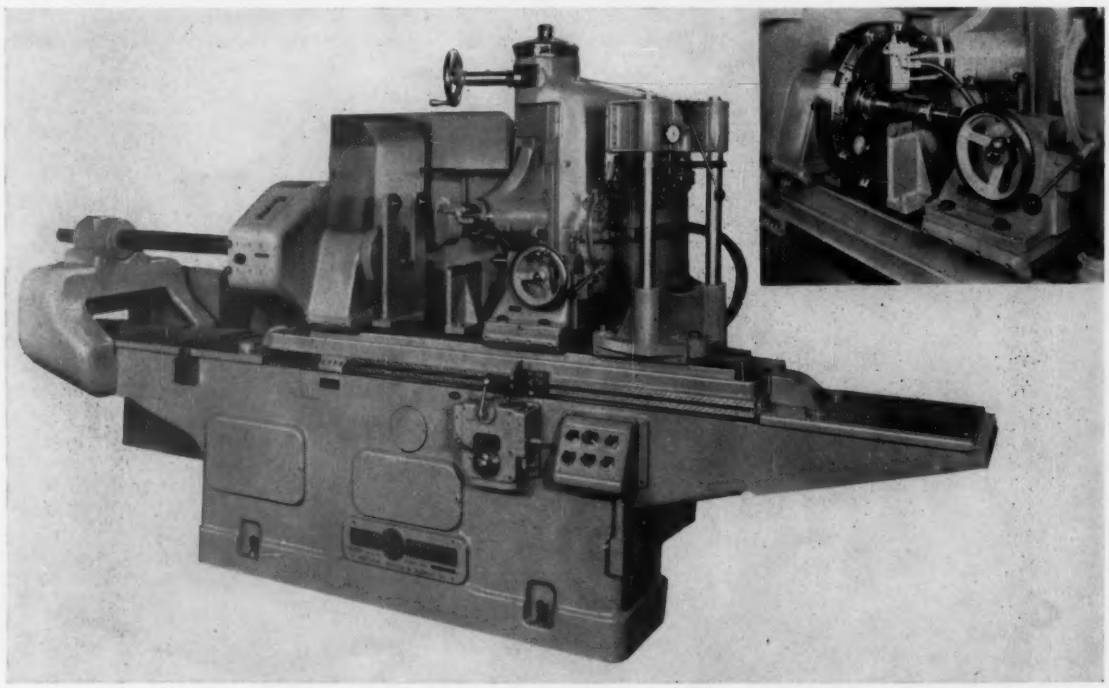
G-E Fractional-Horsepower Explosion-Proof Motor

An explosion-proof fractional-horsepower motor, designed for long life, safe operation in hazardous atmospheres, and minimum maintenance costs, has been announced by the General Purpose Component Motor Department of

General Electric explosion-proof fractional-horsepower motor

the General Electric Co., Schenectady, N. Y. This motor is made with heavy cast-iron end shields for extra protection and overbolt construction to provide additional strength with little increase in weight. Use of a new ball-bearing grease, which is highly resistant to oxidation and moisture, makes possible extra long service with minimum maintenance. The motor has been tested by the Underwriter's Laboratories and approved for Class I, Group D; and Class II, Groups E, F and G atmospheres.

Circle Item 129 on postcard, page 277



Special Red Ring gear grinder that grinds the teeth on an internal helical gear

Versatile Deep-Throat Contour Saw

A contour saw developed to meet the needs of job shops for a low-cost, deep-throat band sawing and filing machine has been announced by the DoAll Co., Des Plaines, Ill. The 30-inch throat depth of this machine makes it especially useful in sheet metal and pattern shops, as well as in small shops making a variety of metal products.

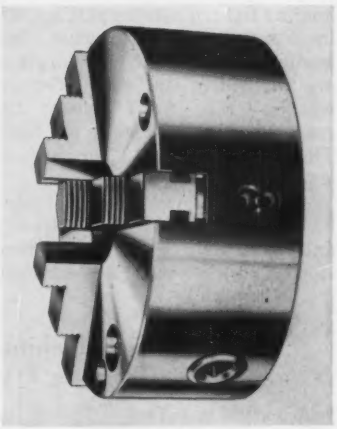
The many features and time-saving attachments incorporated in this machine adapt it for sawing woods, plastics, and numerous other materials. The machine is easily arranged for band filing, metal polishing, finishing, and slicing of hundreds of materials by applying the proper band tool, tool guides, and inexpensive accessories. Carbide tools, for example, can be finish-ground on these machines.

The heavy trunnion and cradle support the 24- by 24-inch worktable which is constructed to handle heavy or large pieces. The table tilts 45 degrees to the right and 10 degrees to the left. The saw blade welder handles blades up to 1/2 inch in width, performing both welding and annealing operations. Standard DoAll saw guides can be interchanged with six other types for specialized sawing, including 90-degree angle guides for cutting off long pieces. In some cases a lower guide can be located above the table surface for trimming operations. In all, twenty different attachments are available for use in contour sawing, filing, and polishing operations.

Circle Item 130 on postcard, page 277

Three-Jaw Scroll Chuck

The Skinner Chuck Co., New Britain, Conn., is manufacturing a "Cent-R-Quick" three-jaw universal scroll chuck that permits precise centering of the work-piece with a total indicated run-out of less than 0.0005 inch. A new single-point, fast-adjustment feature prevents the work from slipping, even under the heaviest cuts, and permits any number of duplicate parts to be chucked accurately without making readjustments. All adjusting is done internally and there is no movement of the chuck body in relation to the machine spindle. The chuck is securely mounted on the spindle in the conventional manner and is operated by a single pinion. In effect, it is said to offer the precision of a four-jaw independent chuck in addition to the quick-operating feature of a self-centering scroll chuck.

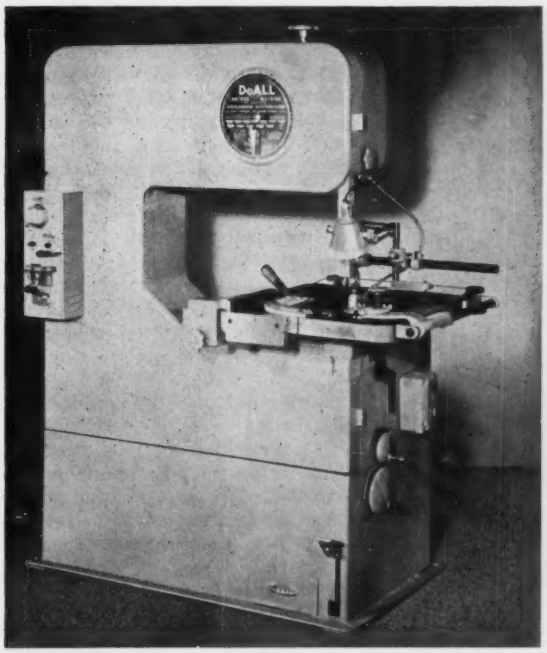


"Cent-R-Quick" three-jaw scroll chuck brought out by Skinner Chuck Co.

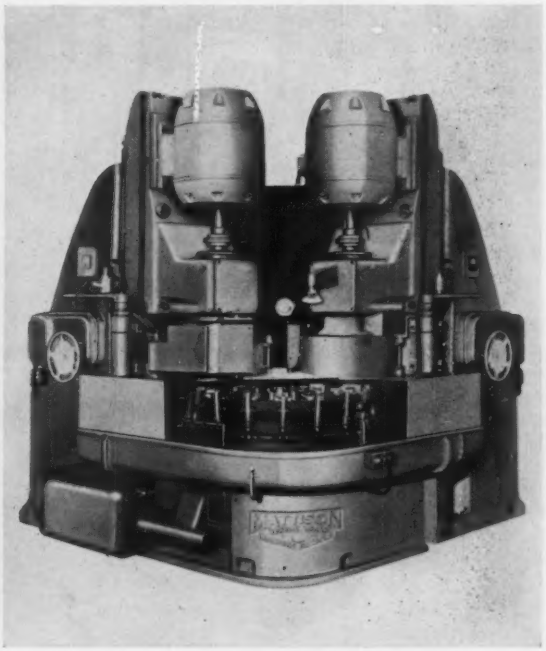
Circle Item 131 on postcard, page 277

Mattison Automatic Grinder for Processing Connecting-Rods

Mattison Machine Works, Rockford, Ill., has brought out an automatic double-spindle, single-pass, rotary table grinding machine for processing large truck engine connecting-rods. Mechanical clamping and unclamping devices operate automatically while each work-



DoAll deep-throat contour saw to meet many needs



Mattison automatic grinder for processing connecting-rods

holding fixture rotates past actuating cams which bracket the loading station. Rough forgings are finished in one pass under the wheels. One wheel grinds the crank ends, the other the pin ends. The wheels remove 0.008 inch of stock on each side.

Automatic down feed—actuated by sizer gages which constantly and accurately check the dimension being machined at each wheelhead—compensates for wheel wear and permits uninterrupted production with only spot-checking of parts for size. Grinding wheels are self-dressing and once the machine is set into motion, the only down time normally required is for replacing a wheel that has been worn beyond its useful limit. The production rate for two operations on two sides is 400 rods per hour.

Circle Item 132 on postcard, page 277

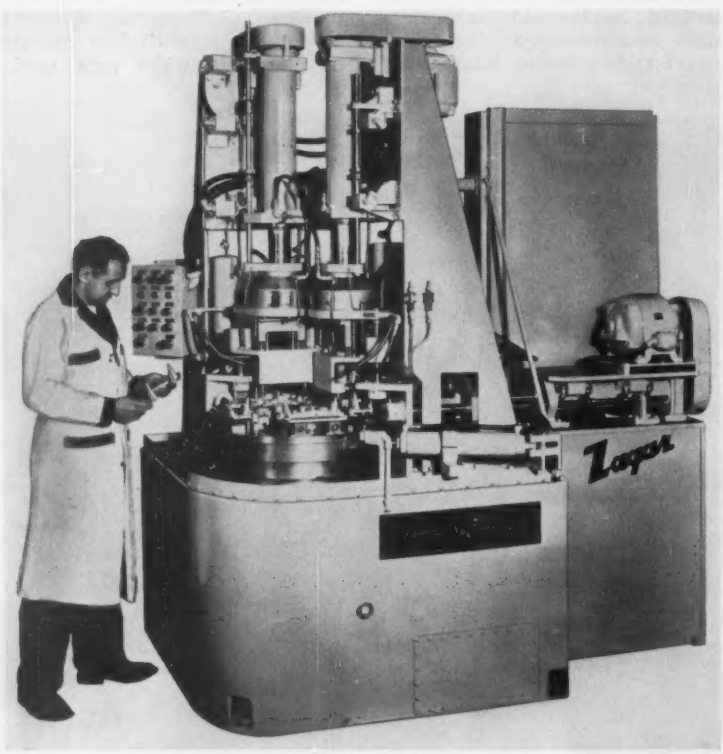
Zagar Special Machine for Drilling, Reaming and Tapping Typewriter Supports

A special machine equipped for drilling, reaming and tapping die-cast segment supports for an electric typewriter has been built by Zagar Tool, Inc., Cleveland, Ohio. The machine is of the four-station index type. At the first station, ten holes are drilled—four in the top face of the support and six more 90 degrees from the top. At the second station, a vertical head reams two holes, each 0.122 inch in diameter, and simultaneously taps four No. 10 holes of 32 pitch in the outer face of the casting. Thus, the part is processed from two directions; namely from the top, by vertical heads, and from the side, by horizontally mounted heads.

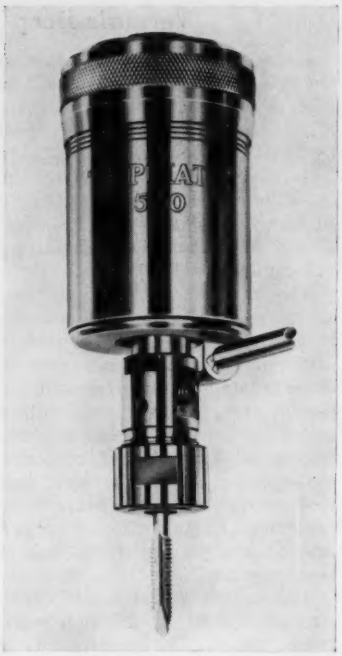
The heads and the hydraulic feed units are of standard or basic Zagar design. Each head has a 10-inch stroke. The tapping head is equipped for precise lead-screw control.

The indexing table is of standard design, actuated by an air cylinder for automatic cycling. A shot-pin assembly serves to accurately position the table. The table is also tied to the drill heads by guide pins to give still further assurance of accurate indexing. The machine is fully automatic.

Circle Item 133 on postcard, page 277



Zagar special machine for processing electric typewriter supports



Tapping attachment brought out by the Tapmatic Corporation

Tapmatic Tapping Attachment

The Tapmatic Corporation, Costa Mesa, Calif., has announced a tapping attachment designed to meet the demand by present users of the Tapmatic "300" for a similar attachment of larger capacity. The new Tapmatic "500" has a capacity for tapping threads in the range of from No. 6 to 1/4 inch. It operates on the same "weightless tapping" principle as the earlier model and does not require the machine operator to exert any lead or feeding pressure. The attachment is said to assure consistently uniform tapped holes, longer tap life and faster tapping. Another feature is its positive torque adjustment clutch which stops the tap instantly when it becomes dull or loaded, hits a hard spot or bottoms in a blind hole. This spring-loaded ball clutch thus reduces tap breakage.

The mechanism of the attachment is designed to permit instantaneous reversal of the tap at any time. The reversing torque is automatically adjusted simultaneously with the driving torque through the one adjustment of the positive mechanical clutch. The reversing mechanism is ball-bearing equipped.

Circle Item 134 on postcard, page 277

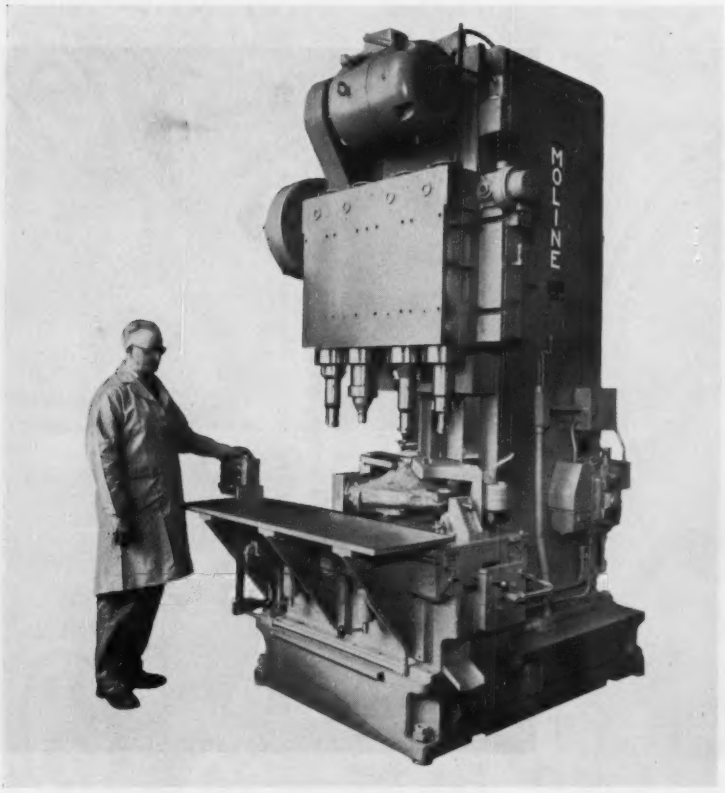
Moline Hydraulic Boring Machine Equipped to Process Transmission Housings

A hydraulic rail-feed boring machine with two-position power shifting fixture originally developed by the Moline Tool Co., Moline, Ill., for boring the cylinders in engine blocks or the cylinder liners for engines, is now being equipped by this company with a special fixture and appropriate tooling for use in rough- and finish-boring, counterboring, facing and chamfering two holes in a transmission housing employed on combine harvesters. Special equipment includes four anti-friction bearing spindle heads to which are attached flange-mounted boring-bars.

The fixture is a two-station power shifting type in which the drive housing is loaded and located on previously milled surfaces. Hand-operated clamping screws are provided to hold the work-piece securely in place. A separate, adjustable-pressure hydraulic pump, independent of the hydraulic feed pump for the machine cycle, is used to shift the fixture from the roughing to the finish-boring position. The hydraulic pressure remains on the shifting cylinder to hold the fixture firmly against positive end-stops during each boring operation. Locating plungers are provided to position the fixture in each of the two working positions.

At the first station the rough-boring operations are completed and then the fixture and housing are automatically shifted to the second station where finish-boring takes place. The work-piece is then removed and the fixture shifted back to the first station to receive the next housing. The fixture-shifting is interlocked with the machine cycle to safeguard the machine and operator.

Circle Item 135 on postcard, page 277



Boring machine built by the Moline Tool Co., for processing transmission housings

Speed Reduction Units

Boston Gear Works, Quincy, Mass., has brought out a line of 100 Series speed reducers of the design shown in Fig. 1. These "Reductors" are made in fifty-two standard stock models—283 different units with ratios from 5 to 1 up to 3600 to 1 and output torque ratings from 40 inch-pounds to 9400 inch-pounds.

Fig. 1. Speed reduction unit made by Boston Gear Works

Fig. 2. (Left) "Ratiomotor" unit and (right) flanged "Reductor"

The company has also brought out a 100 Series line of "Ratiomotors." The standard stock, motorized gear-reduction units of this line are of simplified combination construction which permits removal of the motor at any time without disturbing the gear-reduction unit. Also, the original motor can be easily replaced with a totally enclosed, explosion-proof, or some other special-purpose motor.

The Ratiomotor gear units are available without the motor as flanged Reductors, shown in the view in the lower right-hand corner of Fig. 2, so that the customer can buy and install standard end-mounted motors of his own choice. The Ratiomotors are available in twenty-eight standard stock models—194 different motorized units, with general-purpose or totally enclosed motors, in thirteen different sizes ranging from 1/6 to 10 H.P. to suit various voltage requirements.

Circle Item 136 on postcard, page 277

"Doit" Urslf Kit of Materials for Making Toolmaker's Tools

Kits containing all the materials, drawings, and instructions required by a toolmaker or machinist to enable him to finish and assemble a set of precision toolmaker's tools has been announced by S. J. Williams Precision Tool Kits, Inc., Schiller Park, Ill. These "Doit" Urslf kits have been developed to permit students and apprentices, as well as toolmakers and machinists, to make their own precision tools at comparatively low cost.

Kits are now available for making fourteen precision tools, including toolmaker's vise; magnetic parallels in a variety of lengths and kinds of laminations; magnetic V-blocks, also in a variety of lengths and kinds of laminations; 5-inch sine block; and V-block clamps.

Circle Item 137 on postcard, page 277

Precision tools made from "Doit" Urslf kits introduced by S. J. Williams Precision Tool Kits, Inc.

Feedmatic Rotary Hopper

A rotary hopper, designed to provide accurate, high-speed delivery of parts to machine tools, has been announced by Feedmatic, Inc., of Detroit, Mich. This hopper, called the "160," feeds parts to presses, grinders, special machines and machine tools, and can also be used for sorting, counting and inspection operations. It is built to automatically feed parts three to five times faster than hand-feeding methods.

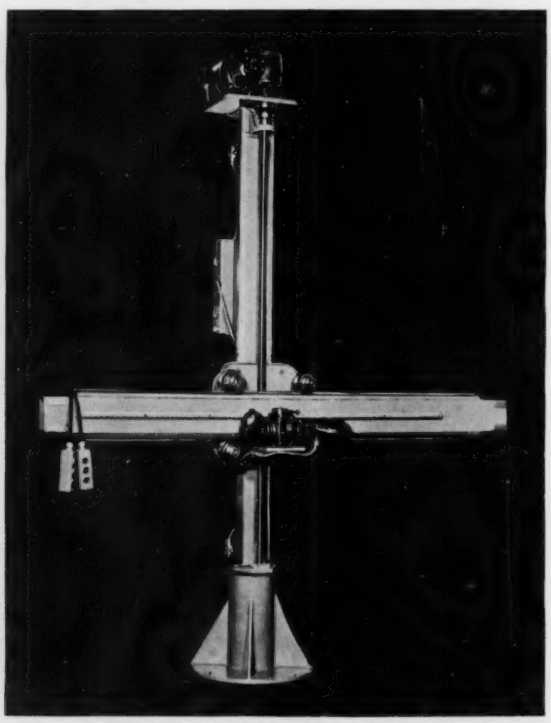
The unit is operated by means of a fully enclosed, continuous-duty motor, and has a slip clutch for overloads, which is easily accessible for adjustment. All gears and bearings operate in an oil bath. The rotary hopper incorporates a three-point mounting in the base, for easy installation on rough or uneven surfaces. Up to four separate feeding tracks can be furnished with the hopper.

Circle Item 138 on postcard, page 277

Cayuga Pedestal Support for Welding Head

To round out its line of automatic welding equipment, the Cayuga Machine & Fabricating Co., Inc., Depew-Buffalo, N. Y.,

Rotary hopper for rapid feeding of parts to machine tools announced by Feedmatic, Inc.



Pedestal for supporting welding head made by Cayuga Machine & Fabricating Co., Inc.

has brought out a versatile, lightweight, precision-built pedestal support for welding heads. This low-cost ram type pedestal is known as the "Warrior." It is designed for longitudinal welding, and for use with turntables, turning rolls, or positioners. The pedestal supports both the welding head and wire reel. A supporting platen which rides on the ways of a vertical column, raises and lowers the ram. The entire mechanism can be rotated 360 degrees.

The maximum vertical clearance from the center line of the ram to the floor is 88 inches, the horizontal ram travel is 72 inches, and the variable ram speed range is from 0 to 120 inches per minute. The vertical speed is constant at 60 inches per minute. The machine has an over-all height of 9 feet, and mast rotation range of 360 degrees. It has push-button control and if desired can be supplied with a four-wheeled carriage to facilitate movement about the shop.

Circle Item 139 on postcard, page 277

Quick-Acting Depth Gage

A quick-acting Mauser vernier depth gage for diemakers, toolmakers and mechanics is announced by the George Scherr Co., New York, N. Y. This gage has a 0.001-inch vernier and is designed to meet the need for a fast- and direct-reading depth gage that is responsive to the most delicate touch. Provision is made for instant adjustment to zero.

A hardened pin 1/32 inch in diameter, held securely by a small set-screw, is used as a feeler point and enables the operator to measure the depth of holes as small as 1/32 inch in diameter. Small, deep holes may be checked by replacing the standard pin with a hardened long, straight pin. The gage is available in two models which have measuring capacities of 3 and 6 inches.

Circle Item 140 on postcard, page 277

Solenoid Pilot Valve for Hydraulic Circuits

A solenoid pilot valve developed for automatic control of hydraulic circuits is announced by Rivett Lathe & Grinder, Inc., Boston, Mass. This valve is of the subplate mounted type for panel installation and is designed for a maximum pressure of 3000 pounds per square inch. The solenoids operate on only 3.6 amperes inrush and 0.45 amperes holding current at 115 volts. The wiring box with terminal strip is dust sealed and has 1/2-inch conduit connections on each side of the valve.

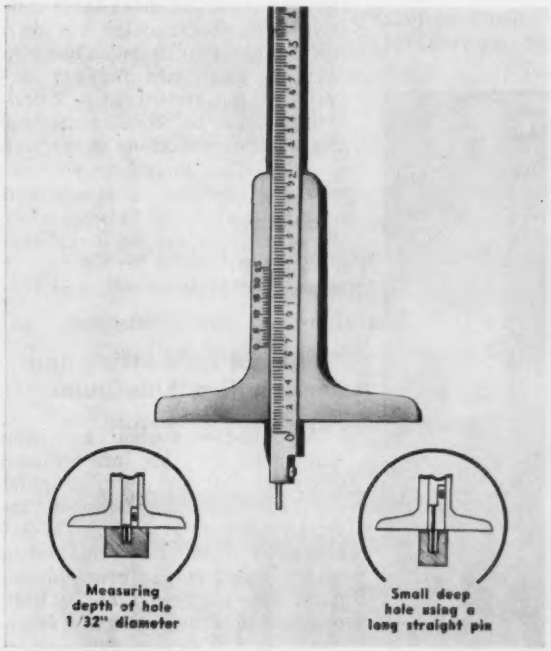
Rivett solenoid pilot valve for hydraulic circuits

The flow capacity of this Series 6500 valve is rated at 3.6 gallons per minute at 15 feet per second. Seven spool designs are available for any circuit control. The valve is furnished in 1/4-inch size in both double- and single-solenoid types. The double-solenoid type is available in a no-spring, two-position design, or a spring-centered, three-position design.

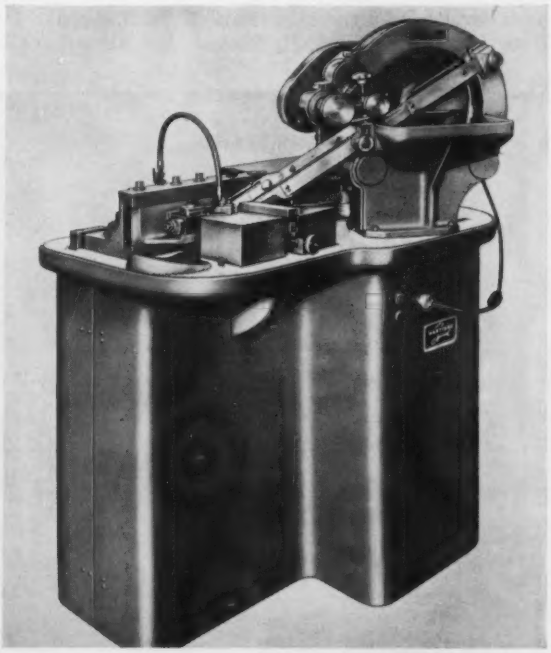
Circle Item 141 on postcard, page 277

Hartford Special Thread-Rolling Machine

The Hartford Special Machinery Co., Hartford, Conn., has announced that production of rolled threads on its new Model A-190-R special thread-rolling machine has been greatly increased through



Mauser quick-acting vernier depth gage introduced by the George Scherr Co.



Special thread-rolling machine with rotary hopper announced by the Hartford Special Machinery Co.

the addition of a feeding system employing a rotary type hopper. The new model is essentially a Hartford special Model A-190-H automatic thread roller to which the self-contained rotary hopper has been added. Production with this combined unit is said to have been increased 75 per cent to give 230 or 250 pieces per minute.

The rotary hopper has a large capacity which permits long runs between refills. Feed rails have been lengthened to accommodate more pieces, thus providing more time for the feed clearing wheel to reject imperfect blanks which could clog the feed rail. In addition, a built-in vibrator assures positive positioning and feeding of blanks.

The rotary hopper is completely self-contained and has been designed for easy maintenance and repair. Power from a 1/12-H.P. motor drives the hopper independently, permitting variable bucket speeds to be obtained by changing gears. The screw or thread diameter capacity runs from machine screw sizes No. 2 (0.086 inch) to No. 10 (0.190 inch). Thread length capacity is 1/8 inch to 1 1/2 inches with standard depth dies, and 2 inches with special depth dies. Flat type dies are used.

Circle Item 142 on postcard, page 277

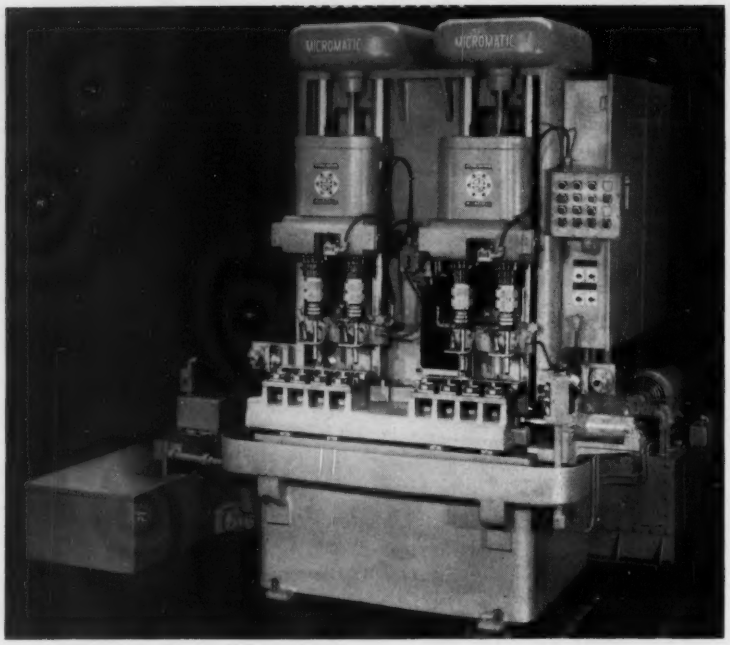


Fig. 1. Microhoning machine made by the Micromatic Hone Corporation

Microhoning Machine for Finishing Connecting-Rod Bores

A four-spindle Microhoning machine, known as Model 710-4, has been developed by the Micromatic Hone Corporation, Detroit, Mich., for finishing the wrist-pin and crankpin holes in automotive connecting-rods. Two double-spindle machines have been incorporated in this model to obtain increased production. The reciprocating head assembly of each unit has a stroke capacity of 10 inches. Each head has individual automatic stone feed and wear compensation as well as automatic sizing control.

Automatic indexing and operator safety are provided by controls that interlock the index-table controls with the machine controls. Each of the four spindles has two fixtures which are indexed laterally at the end of each Microhoning cycle to align themselves alternately with their respective spindles. This lateral travel permits the operator to unload and reload one group of fixtures while the other four are in the Microhoning position.

Circle Item 143 on postcard, page 277

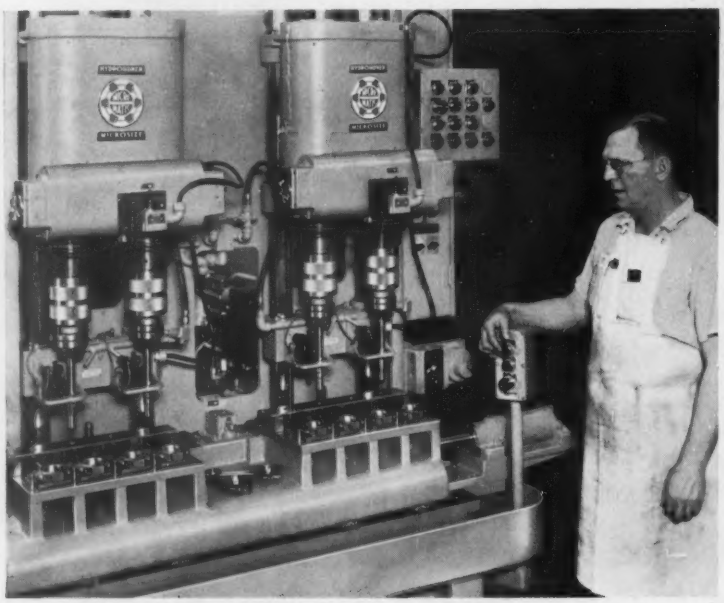
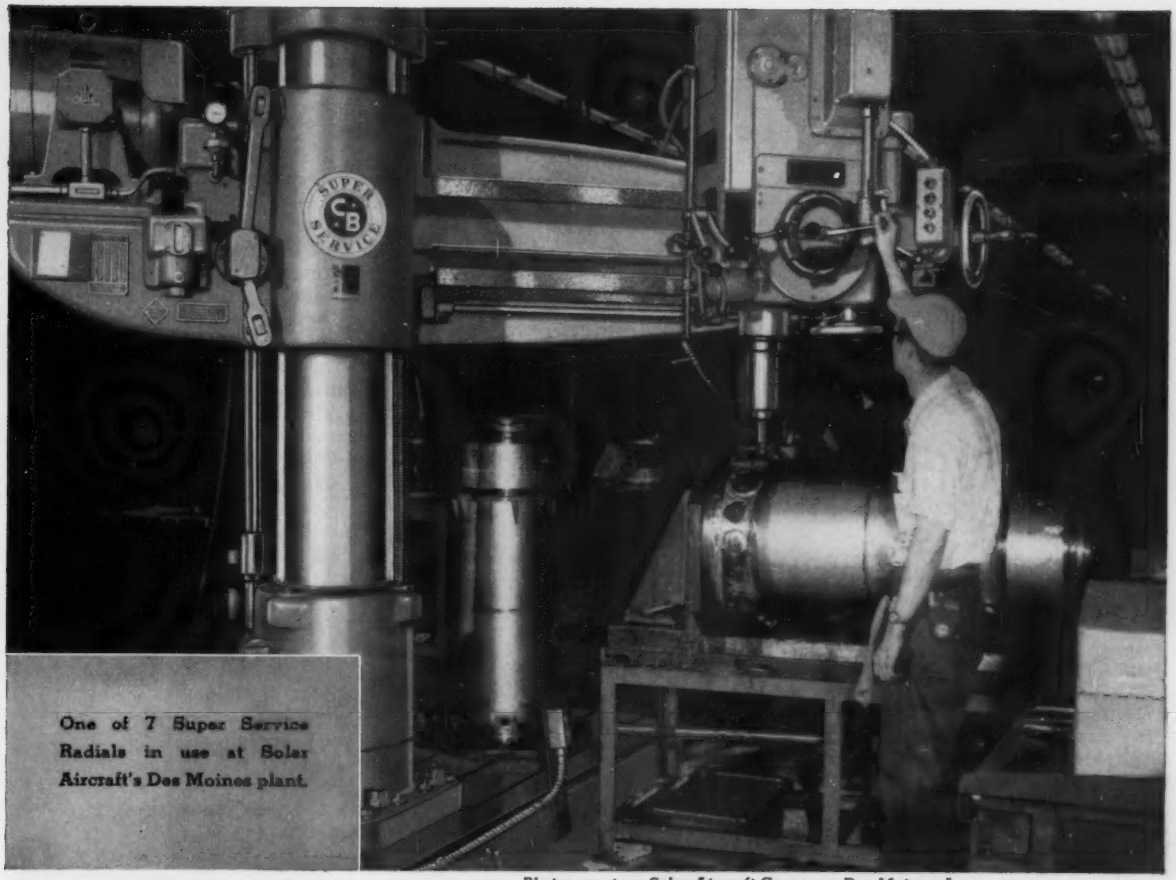


Fig. 2. Close-up of work and tools of machine shown in Fig. 1

Coolant for Cutting and Grinding Aluminum

A stain-free coolant has been announced by the International Chemical Co., Inc., Philadelphia, Pa. This product, designated "International Compound 131-A," should be of particular interest to plants which cut or grind aluminum. The compound has a high degree of lubricity and detergency, as well as anti-weld properties. It mixes with water to form a stable emulsion.

Circle Item 144 on postcard, page 277



One of 7 Super Service Radials in use at Solar Aircraft's Des Moines plant.

Photos courtesy Solar Aircraft Company, Des Moines, Iowa.

"well pleased..."

"Our production people and our plant engineering department, who install and service equipment, are well pleased with our Cincinnati Bickford drilling machines." • **Solar Aircraft Company**

Both large and small Cincinnati Bickford Super Service Radial Drills are used here in producing jet engine components. The arm of the machine shown above is swinging over two working positions permitting the completion of all drilling operations at both stations with a minimum of work handling. Altogether there are 10 holes drilled and reamed, 18 holes drilled and tapped, and two .656" dia. half moon radii accurately machined in this tough high-alloy steel. The accuracy, speed and trouble-free performance, the power and easy control of these machines have made them popular to both engineers and operators.

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Westinghouse motor-pump

Hermetically Sealed Motor-Pumps

Sealed motor-pumps that will handle radioactive water with zero leakage in capacities from 5 to 17,000 gallons per minute are available from the Westinghouse Electric Corporation, Pittsburgh, Pa. Although originally designed to circulate water between the nuclear reactor and the steam generator in a high-temperature, high-pressure, closed-loop system, these pumps provide a convenient means of pumping water—or many other fluids—at system pressures up to 2500 pounds per square inch and temperatures as high as 650 degrees F.

Units of special design are available for handling liquid metal at system temperatures as high as 1000 degrees F. Pumps can also be designed to handle liquids at system pressures up to 10,000 pounds per square inch. All parts in contact with the pumped fluid are made of corrosion-resistant alloys. There are no external seals.

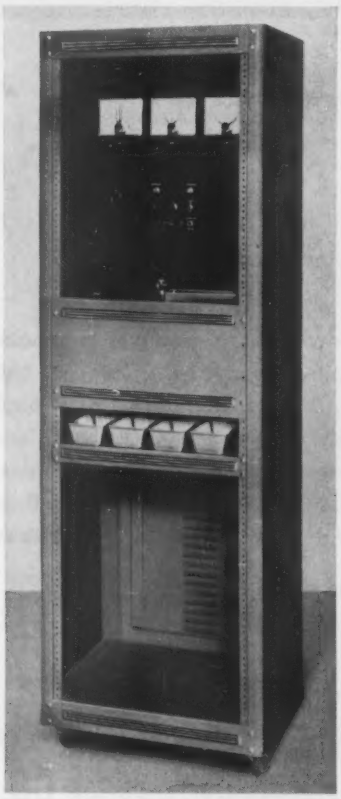
Circle Item 145 on postcard, page 277

Cleveland Automatic Gaging and Sorting Unit

The Cleveland Instrument Co., Cleveland, Ohio, has built an automatic inspection unit for gaging and sorting parts into as many as five specific size categories, plus over- and under-size groups, at speeds of more than 3000 parts per hour. This unit, known as the Autosort Model 101, handles parts up to 3 inches in length with outside diameters up to 3/4 inch and can be arranged for checking length, thickness, outside diameter, or any other external measurement. It can be furnished for any size range desired from 0.002 to 0.010 inch and for sorting, by increments, as small as 0.000050 inch.

The parts to be measured are fed from a hopper by motor-driven fingers and are placed, one at a time, on an anvil beneath a "Par-Ac" gage head. A voltage produced by the gage head goes through an amplifier to three contact meters. The meter hands are then positioned according to the size of the part being measured. These hands make contact with the pre-set contact arms to actuate a relay system, and this, in turn, energizes a sorting-gate solenoid that corresponds to the size group of the part. The part is next pushed off the anvil by the succeeding part to be gaged and then drops vertically until it is deflected by the solenoid-operated gate into a corresponding discharge chute.

Circle Item 146 on postcard, page 277



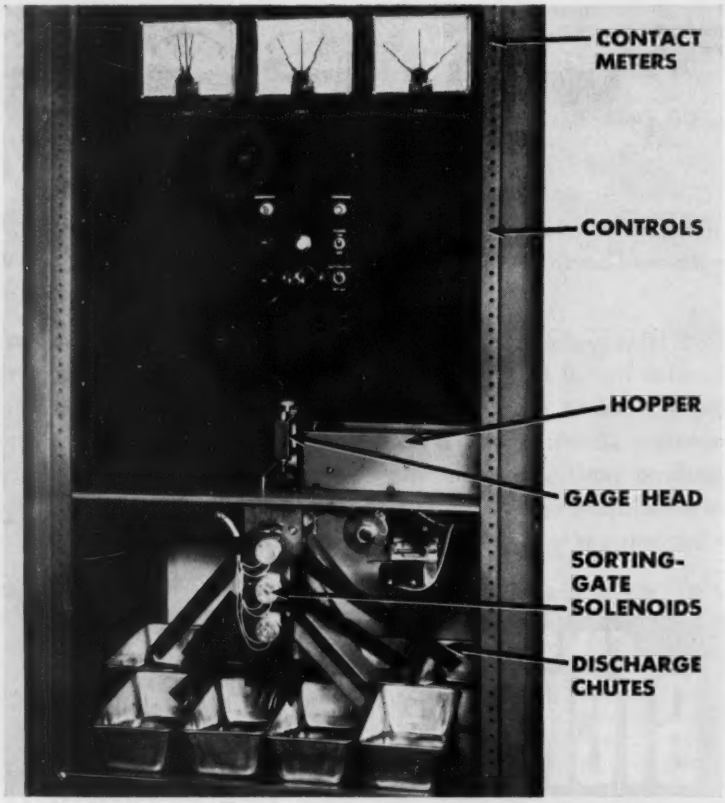


Fig. 1. (Left) Front view of Cleveland Autosort unit. Fig 2. (Right) Close-up showing principal parts.

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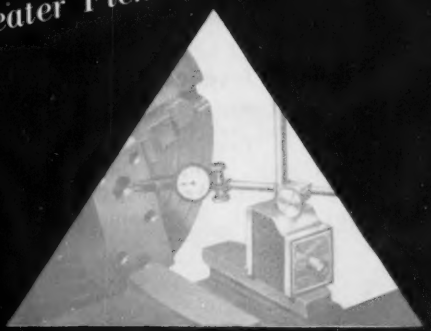

Powerful permanent magnet energizes both sides and bottom of Magnicator base for holding to flat surfaces. V in top holds to round surfaces.

New holding tool for dial indicators — THE MAGNICATOR

NOW YOU CAN PERFORM the most difficult dial indicator tests quickly and positively — thanks to the Magnicator's exclusive design features. Simply press the "ON" button and a powerful permanent magnet anchors the base in any position — even on round surfaces! Press to "OFF", and the base is completely free . . . instantly! The compact, lightweight holding tool for hundreds of precision tests . . . even those impossible with "conventional" testing tools. Send for complete details. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island, U.S.A.

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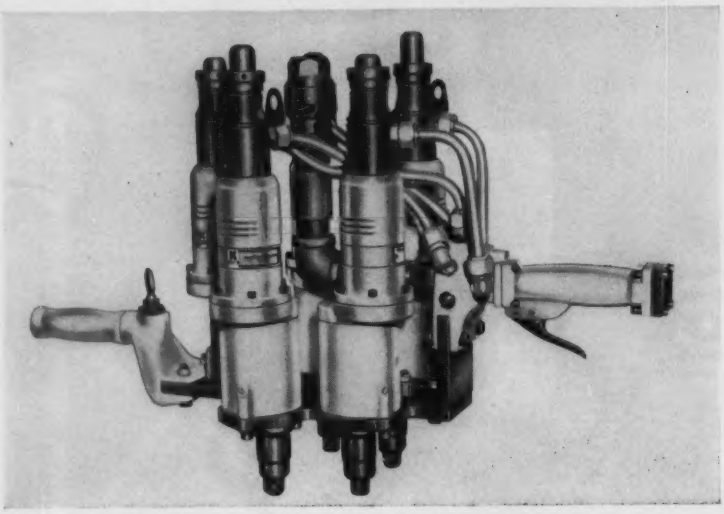
Multiple Nut-Setter Motors

Several new motor sizes and styles for the multiple nut-setters made by the Keller Tool Division of Gardner-Denver, Grand Haven, Mich., have been introduced by the company. These motors are said to bring increased flexibility to the nut-setters which were originally designed for a high degree of versatility. They can now set even more closely grouped nuts and bolts than before, and meet all torque requirements from 4 to 190 foot-pounds.

The nut-setter can be used to run from one to ten or more nuts or bolts simultaneously, and each can be set to the same or a different torque, as desired. Each motor spindle has an integral torque regulator that can be adjusted easily over the entire range of the motor, and the high accuracy of the regulator permits the torque to be held within very close limits. The twenty-eight motor sizes and styles provide a wide selection of speeds and possible mountings.

Circle Item 147 on postcard, page 277



Keller multiple nut-setter with new style motor

Ingersoll Electric Micrometer

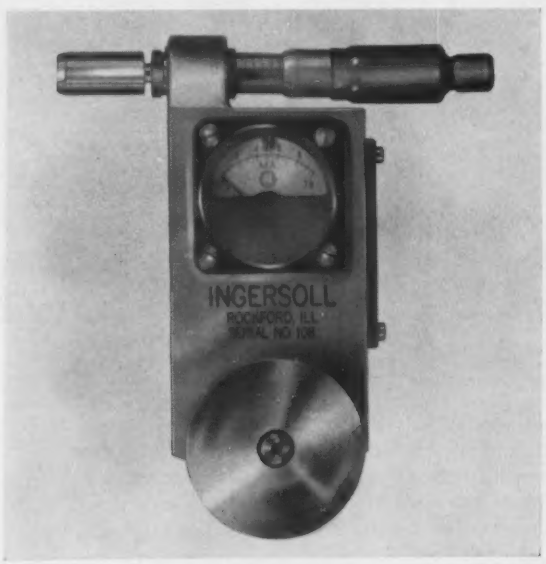
An electric micrometer designed to simplify the alignment of heavy machinery, aircraft jigs, transfer machines, and many other kinds of equipment has been introduced by the Ingersoll Milling Machine Co., Rockford, Ill. This precision instrument provides a means for checking vertical alignment and lateral horizontal alignment over substantial distances where conventional micrometers cannot be used effectively. It is designed to give readings quickly which are accurate within 0.0002 inch and can be operated by anyone familiar with a standard micrometer.

A magnetic-base platform and a C-clamp which make it possible to mount the instrument almost anywhere, and in any position, are furnished with the micrometer. This instrument was originally developed for the company's own work in manufacturing special milling and boring machines.

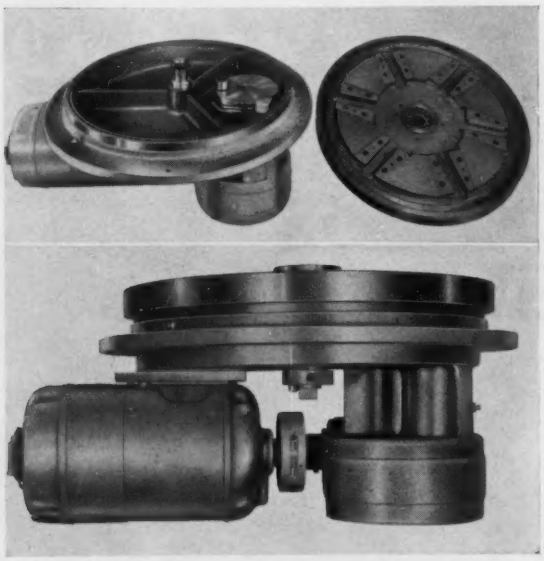
Circle Item 148 on postcard, page 277

Cleveland Power-Operated Index-Tables

The Cleveland Tapping Machine Co., Canton, Ohio, has just announced a new power-driven automatic index-table which will be



Electric micrometer developed for use in aligning heavy machines and equipment brought out by the Ingersoll Milling Machine Co.



(Upper view) Top of Cleveland index-table removed to show the Geneva indexing mechanism. (Lower view) power-driven automatic index-table

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MAKING A SLEEVE FOR A TOOL GRINDING MACHINE . . .

AT

BELL AIRCRAFT
CORPORATION
IN
BUFFALO, NEW YORK

Operations like this are always interesting to concerns who need dependable, cost-cutting lathes for their own products or to build equipment for others.

For example, at Bell Aircraft, Buffalo, New York, this SIDNEY LATHE is making a sleeve for a tool grinding machine which will be used for grinding parts for their rocket engines. Naturally they need and get allowable tolerances of .001 (±) without any trouble.

Bell Aircraft also uses SIDNEY LATHES to machine gear cutters which are used in connection with their guided missile program.

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WRITE FOR BULLETINS

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Builders of Precision Machinery since 1904

available in 21- and 34-inch table diameters and with six, eight, and twelve stations. These tables are operated by a Geneva drive, using a needle-bearing cam-follower operating in ways faced with hardened and ground tool-steel wearing plates. The hardened and ground tool-steel lock-pin, actuated by a cam-plate, enters the ways before the cam follower leaves them so that, at no time in the operation of the table, can it be freewheeled.

A 220-440-volt, 60-cycle, three-phase motor having a speed of 1800 R.P.M. drives the table through a worm-gear reduction unit. The table revolves on a large, double-row precision ball thrust bearing, and the drive-shaft from the reduction unit operates in precision ball bearings while the locking pin travels in hardened steel guides. All shafts are pressure lubricated and all working parts are protected against damage by coolant or chips. Both models are furnished with tables equipped with locators for interchangeable top plates and can be furnished with an adapter which permits horizontal mounting for use as the drive for an indexing drum.

The 21-inch model is driven by a 3/4-H.P. motor and has a load capacity of 400 pounds with an indexing cycle of 1.5 seconds under normal operating conditions. It may be equipped with top plates up to 32 inches in diameter and, with a work cycle of three seconds, is capable of 800 operations an hour. The 34-inch table, driven by a 1-H.P. motor, will carry an 800-pound load with an indexing cycle of two seconds.

Circle Item 149 on postcard, page 277

Stoker & Yale Tap Analyzer

A tap analyzer incorporating an accurate measuring microscope and means for holding a tap in a firm position and in a definite relationship to the several calibrated motions of the instrument, is being made by Stoker & Yale, Inc., Marblehead, Mass. Geometric contours of taps which govern cutting efficiency and accuracy can be suitably measured on this analyzer with tolerance specifications of 0.0001 inch. Basically the tap analyzer is an instrument featuring a monocular microscope which may be brought to focus on any portion of a chucked tap from any angle desired. Accurately calibrated dials on the collet head and on the microscope assembly have scales from which the required measurements can be made to exceptionally close tolerances.

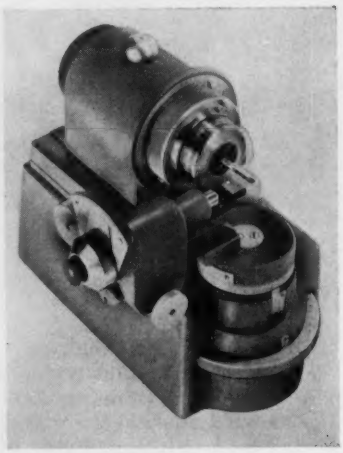
Circle Item 150 on postcard, page 277

Parker Tube Bender with Toggle Clamp

The Model 824 bench-mounted manual tube bender introduced by the Parker Appliance Co., Cleveland, Ohio, for use in the fabrication of metal tubing for fluid-handling systems, is now available with a new toggle clamp designed for easier and speedier operation. The toggle clamp, through simple manipulation of the operating handle, saves time by providing quicker gripping of the tube to be bent. The clamp is attached merely by inserting its swivel-block pin into the third hole of the radius block.

The toggle clamp, without the shoe insert, accommodates tubing having outside diameters up to 1 1/2 inches. Shoe inserts are available for tubing sizes with outside diameters ranging from 3/8 inch through 1 1/4 inches.

Circle Item 151 on postcard, page 277

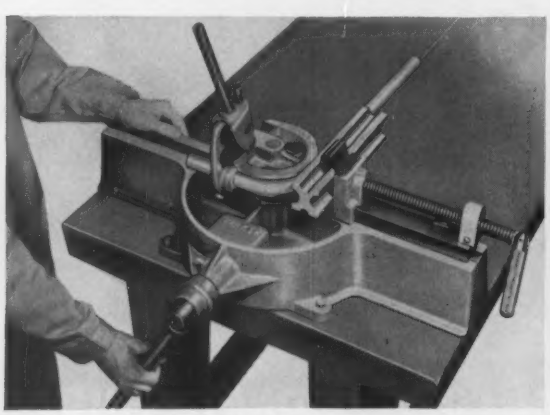


Tap analyzer brought out by Stoker & Yale

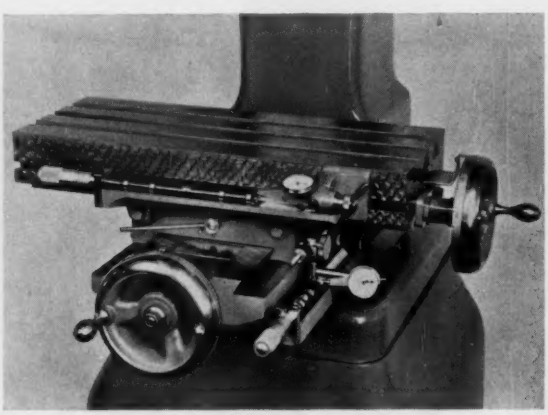
End-Measuring Rod Equipment for Linley Jig-Boring Machine

End-measuring rod equipment designed for use on its jig-boring machine has been introduced by Linley Bros. Co., Bridgeport, Conn. This equipment includes two 1-inch micrometer heads intended for permanent mounting on the machine, and nine individual rods for use in making the measurements. Two troughs for holding the nine end-measuring rods (which cover the range from 1 inch

(*Continued on page 262*)



Parker bench-mounted tube bender equipped with toggle clamp



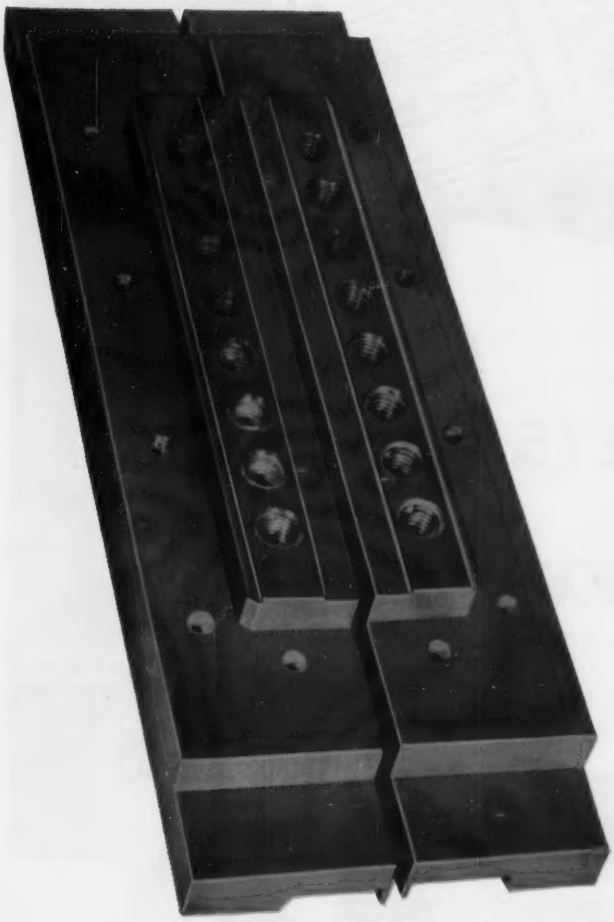
Linley jig-boring machine with end-measuring rod equipment

REVERE

COPPER EXTRUDED SHAPE

SAVES

26% FOR TOCCO



Here is a "fishtail" and the Revere Copper Shape from which it is made. The part is a terminal block on a high frequency transformer, used in induction heating apparatus made by the Tocco Division of the Ohio Crankshaft Co., Cleveland, Ohio. Tocco is an important supplier of induction heating equipment to industry, which uses it for such diverse jobs as heat-treating and hardening, brazing, soldering, removal of gases from metal parts of vacuum tubes, vacuum casting, and heating before forging, upsetting, or other hot working.

The "fishtail" formerly was machined from solid copper bar, and on a typical run, the total cost for a certain number of pieces was $35,000. Revere studied the part with Tocco, and suggested that a shape would save money, even though the plain bar cost 10 cents less per pound. Actual experience produced these figures: total cost on the same number of fishtails, $25,700, a saving of $9,300, or 26.6%.

If your shop is machining plain rod or bar, it might pay you to consider the advantages of extruded shapes. Revere produces them in copper and its alloys, and aluminum alloys. Many design details can be preformed for you, provided they are parallel to the axis of extrusion. Revere would be glad to collaborate with you and see if shapes cannot save you money. See the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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For more information on products advertised, use Inquiry Card, page 277

RECOMMENDED TEMPERATURES FOR PREHEATING METALS PRIOR TO WELDING*—1

Metal Designation	Approximate Composition, Per Cent							Recommended Preheat, Degrees F.
	Carbon	Manganese	Silicon	Chromium	Nickel	Molybdenum	Copper	
PLAIN CARBON STEELS								
Plain Carbon Steel ...	Below 0.20	....	....	....	....	....	....	Up to 200
Plain Carbon Steel ...	0.20–0.30	....	....	....	....	....	....	200–300
Plain Carbon Steel ...	0.30–0.45	....	....	....	....	....	....	300–500
Plain Carbon Steel ...	0.45–0.80	....	....	....	....	....	....	500–800
CARBON-MOLYBDENUM STEELS								
Carbon-molybdenum Steel	0.10–0.20	....	....	....	....	0.50	....	300–500
Carbon-molybdenum Steel	0.20–0.30	....	....	....	....	0.50	....	400–600
Carbon-molybdenum Steel	0.30–0.35	....	....	....	....	0.50	....	500–800
MANGANESE STEELS								
Silicon Structural Steel	0.35	0.80	0.25	....	....	....	....	300–500
Medium Manganese Steel	0.20–0.25	1.0–1.75	....	....	....	....	....	300–500
SAE 1330 Steel	0.30	1.75	....	....	....	....	....	400–600
SAE 1340 Steel	0.40	1.75	....	....	....	....	....	500–800
SAE 1350 Steel	0.50	1.75	....	....	....	....	....	600–900
Manganese Steel	1.25	12.0	....	....	....	....	....	Usually not required
HIGH-TENSILE STEELS								
Manganese-molybdenum Steel ..	0.20	1.65	0.20	....	....	0.35	....	300–500
Jalten Steel	0.35 Max.	1.50	0.30	....	....	....	0.40	400–600
Manten Steel	0.30 Max.	1.35	0.30	....	....	....	0.20	400–600
Armco High-tensile Steel	0.12 Max.	....	....	....	0.50 Min.	0.05 Min.	0.35 Min.	Up to 200
Double Strength No. 1 Steel	0.12 Max.	0.75	....	....	0.50–1.25	0.10 Min.	0.50–1.50	300–600
Double Strength No. 1A Steel	0.30 Max.	0.75	....	....	0.50–1.25	0.10 Min.	0.50–1.50	400–700
Mayari R Steel	0.12 Max.	0.75	0.35	0.2–1.0	0.25–0.75	....	0.60	Up to 300
Otiscoloy Steel	0.12 Max.	1.25	0.10 Max	0.10 Max.	....	....	0.50 Max.	200–400
Nax High-tensile Steel†	0.15–0.25	....	0.75	0.60	0.17	0.15 Max.	0.25 Max.	Up to 300
Cromansil Steel	0.14 Max.	1.25	0.75	0.50	....	....	....	300–400
A. W. Dyn-El Steel ...	0.11–0.14	....	....	....	....	....	0.40	Up to 300
Corten Steel	0.12 Max.	....	0.25–1.0	0.5–1.5	0.55 Max.	....	0.40	200–400
Chromium-copper-nickel Steel	0.12 Max.	0.75	....	0.75	0.75	....	0.55	200–400
Chromium-maganese Steel	0.40	0.90	....	0.40	....	....	....	400–600
Yoloy Steel	0.05–0.35	0.3–1.0	....	....	1.75	....	1.0	200–600
Hi-Steel	0.12 Max.	0.6	0.3 Max.	....	0.55	....	0.9–1.25	200–500
NICKEL STEELS								
SAE 2015 Steel	0.10–0.20	....	....	....	0.50	....	....	Up to 300
SAE 2115 Steel	0.10–0.20	....	....	....	1.50	....	....	200–300
Nickel Steel	0.10–0.20	....	....	....	2.50	....	....	200–400
SAE 2315 Steel	0.15	....	....	....	3.50	....	....	200–500
SAE 2320 Steel	0.20	....	....	....	3.50	....	....	200–500
SAE 2330 Steel	0.30	....	....	....	3.50	....	....	300–600
SAE 2340 Steel	0.40	....	....	....	3.50	....	....	400–700

* Preheating metals prior to welding in accordance with the temperatures given in this and the succeeding data sheet is recommended to eliminate the danger of forming cracks, to reduce hardness and distortion, and to reduce or prevent shrinkage stresses.

† This steel contains 0.12 per cent zirconium.

Compiled by Tempil Corporation

RECOMMENDED TEMPERATURES FOR PREHEATING METALS PRIOR TO WELDING*—2

Metal Designation	Approximate Composition, Per Cent							Recommended Preheat, Degrees F.
	Carbon	Manganese	Silicon	Chromium	Nickel	Molybdenum	Copper	
NICKEL-CHROMIUM STEELS								
SAE 3115 Steel	0.15	....	....	0.60	1.25	....	....	200–400
SAE 3125 Steel	0.25	....	....	0.60	1.25	....	....	300–500
SAE 3130 Steel	0.30	....	....	0.60	1.25	....	....	400–700
SAE 3140 Steel	0.40	....	....	0.60	1.25	....	....	500–800
SAE 3150 Steel	0.50	....	....	0.60	1.25	....	....	600–900
SAE 3215 Steel	0.15	....	....	1.00	1.75	....	....	300–500
SAE 3230 Steel	0.30	....	....	1.00	1.75	....	....	500–700
SAE 3240 Steel	0.40	....	....	1.00	1.75	....	....	700–1000
SAE 3250 Steel	0.50	....	....	1.00	1.75	....	....	900–1100
SAE 3315 Steel	0.15	....	....	1.50	3.50	....	....	500–700
SAE 3325 Steel	0.25	....	....	1.50	3.50	....	....	900–1100
SAE 3435 Steel	0.35	....	....	0.75	3.00	....	....	900–1100
SAE 3450 Steel	0.50	....	....	0.75	3.00	....	....	900–1100
MOLYBDENUM STEELS								
SAE 4140 Steel	0.40	....	....	0.95	....	0.20	....	600–800
SAE 4340 Steel	0.40	....	....	0.65	1.75	0.35	....	700–900
SAE 4615 Steel	0.15	....	....	....	1.80	0.25	....	400–600
SAE 4630 Steel	0.30	....	....	....	1.80	0.25	....	500–700
SAE 4640 Steel	0.40	....	....	....	1.80	0.25	....	600–800
SAE 4820 Steel	0.20	....	....	....	3.50	0.25	....	600–800
LOW CHROMIUM-MOLYBDENUM STEELS								
Molybdenum Steel	Up to 0.15	....	....	2.0	....	0.5	....	400–600
Molybdenum Steel	0.15–0.25	....	....	2.0	....	0.5	....	500–800
Molybdenum Steel	Up to 0.15	....	....	2.0	....	1.0	....	500–700
Molybdenum Steel	0.15–0.25	....	....	2.0	....	1.0	....	600–800
MEDIUM CHROMIUM-MOLYBDENUM STEELS								
Molybdenum Steel	Up to 0.15	....	....	5.0	....	0.5	....	500–800
Molybdenum Steel	0.15–0.25	....	....	5.0	....	0.5	....	600-900
Molybdenum Steel	0.15 Max.	....	....	8.0	....	1.0	....	600-900
STAINLESS CHROMIUM STEELS								
Chromium Type 410	0.10	....	....	13.0	....	....	....	300–500
Chromium Type 430	0.10	....	....	17.0	....	....	....	300–500
Chromium Type 446	0.10	....	....	26.0	....	....	....	300–500
STAINLESS CHROMIUM-NICKEL STEELS								
18-8 Type 304	0.07	....	....	18.0	8.0	....	....	Usually do not require preheat but it may be desirable to remove chill
25-12 Type 309	0.07	....	....	25.0	12.0	....	....	
25-20 Type 310	0.10	....	....	25.0	20.0	....	....	
18-8 Columbium Type 347†	0.07	....	....	18.0	8.0	....	....	
18-8 Molybdenum Type 316	0.07	....	....	18.0	8.0	2.5	....	
18-8 Molybdenum Type 317	0.07	....	....	18.0	8.0	3.5	....	
IRONS								
Cast Iron	....	....	....	....	....	....	....	700–900
Ni Resist	....	....	....	....	....	....	....	500–1000
NON-FERROUS METALS								
Aluminum	....	....	....	....	....	....	....	500–700
Monel	....	....	....	....	....	....	....	200–300
Nickel	....	....	....	....	....	....	....	200–300
Inconel	....	....	....	....	....	....	....	200–300
Copper	....	....	....	....	....	....	....	500–800
Zinc	....	....	....	....	....	....	....	200–300

* See footnote accompanying preceding data sheet.
† The columbium content of this steel is ten times the carbon content.

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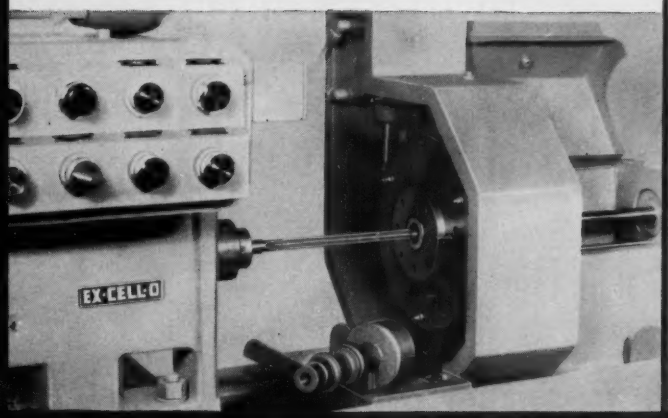
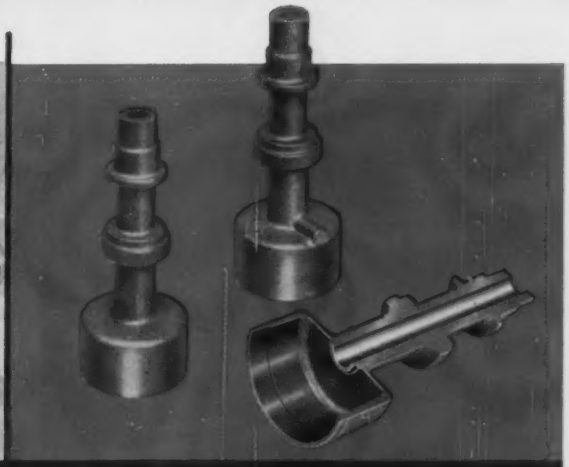


Photo with guards removed shows drill about to enter the guide bushing in the center of the chuck. Coolant oil under high pressure is directed through the spindle and drill, washing chips out of the single flute.



On this cast-iron distributor base, holes are machined straight and round within .0005"; diameter is also held within .0005"; finish does not exceed 15 rms. The hole is completed from start to finish in 30 seconds.

XLO
EX-CELL-O for PRECISION

Today's method by EX-CELL-O for reducing your costs

BOR-DRIL

for straight, accurate holes from solid with good finish—on standard machines

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

Equipped to Bor-Dril is this standard Style 2112-A, the smallest single-end model in the Ex-Cell-O Precision Boring Machine line. These machines are rigid, have easily adjustable feeds, vibration-free spindles. Multiple spindle applications for high production.

For more information on Bor-Dril, or for a quotation on a machine equipped for this work, call in your local Ex-Cell-O Representative or contact Ex-Cell-O in Detroit.

EX-CELL-O CORPORATION

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
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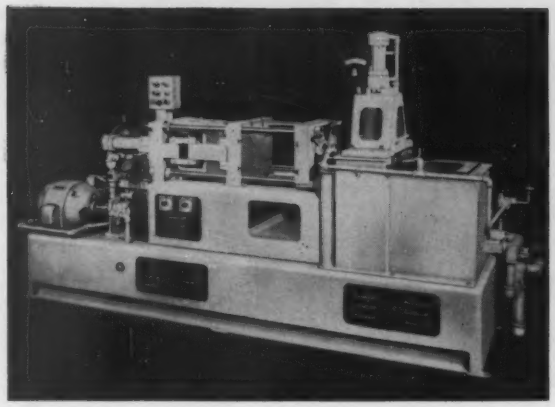
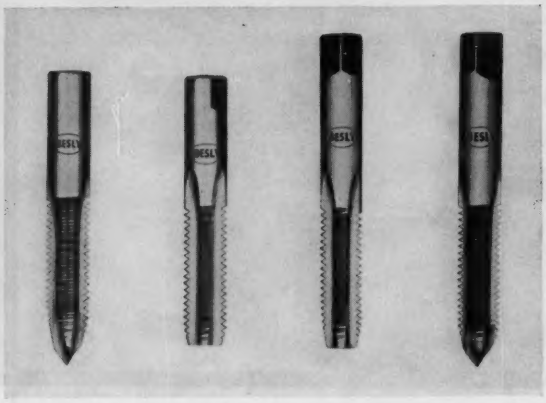
55-16



High-speed die-casting machine of welded steel construction made by American Die Casting Machinery Co.



Besly-Welles short-length or stub taps shown at left of the two standard taps illustrated at right

to 9 inches in even inches, two indicators reading to 0.0001 inch, the necessary adjusting brackets and adjusting screws complete the equipment.

Spotting, drilling, and rough-boring operations are done in the conventional way, employing feed-screws and the handwheel dial readings to control depths.

The new end-measuring system is employed for the finish-boring operation only. For this work, the operator first locates or "picks up" the starting point for measurements on the edge of the work, or a hole, as required. After this position is found, the micrometer head is set at zero, and a rod long enough to cover the job is placed in the trough. The dial indicator is then brought in contact with the end of the rod for a zero setting. The indicator is clamped in this position, where it remains for the entire job. As the operator proceeds from hole to hole, successively shorter inch rods are used. Only one measuring rod is used for each setting.

In making the next setting, the inch part of the dimensions is subtracted from the length of the original rod. The resulting whole number is the length of the next rod to be used. As it is only necessary to subtract whole numbers, figuring is reduced to a minimum. The fractional or decimal part of the dimension is then set on the micrometer head, and the table and indicator as a unit are advanced to the rod for another zero dial reading. This accurately positions the work for the boring operation. Each consecutive hole is located in exactly the same manner as the preceding one.

Circle Item 152 on postcard, page 277

High-Speed Die-Casting Machine

The American Die Casting Machinery Co., Chicago, Ill., has announced a low-cost, high-speed die-casting machine that will handle shot capacities up to 2 1/2 pounds. Outstanding features include all-steel welded construction, 80-ton locking pressure, and automatic electric cycling at high speed (up to 700 shots per hour). The machine has die platens 17 3/4 inches square, a die stroke of 6 inches, and is equipped with a blast type furnace blower. It has moving platens supported by bronze carrier shoes, and efficient controls and valves mounted for operating convenience.

This machine is available in air- or hydraulically-operated plunger gooseneck type for zinc, tin and lead, or cold-chamber type for aluminum, brass, and magnesium. Standard or fire-resistant fluids may be used in the hydraulic unit.

Circle Item 153 on postcard, page 277

All-Purpose Coolant Concentrate

A thixotropic emulsion of pure mineral oil, called RACC, has been announced by the Riesen Chemical Corporation, Milwaukee, Wis. The emulsion is soluble in water to any proportion, and no sulphonated oil, soaps, or fatty acids are present. RACC emulsion can be used full strength for hand tapping, reaming, or for work on a horizontal machine. For general machine shop work, a 25 to 1 dilution is recommended, and for grinding and honing, a 100 to 1 dilution is suggested.

Circle Item 154 on postcard, page 277

Besly-Welles Short-Length Taps for Screw Machines

A short-length tap that need not be shortened for use in screw machines has just been made available as a regular product of the Besly-Welles Corporation, Beloit, Wis. Developed in cooperation with the National Screw Machine Products Association, the new tap conforms to standards recently drawn up by that group. It is not intended that these short-length taps have any effect on existing tap standards, but rather that they serve to supplement existing standards by providing greater tapping convenience, improving accuracy, and cutting tool costs on work for which they are adapted.

Both the shank and threaded portions of the new stub tap have been shortened to enable it to fit into the space between the spindle-nose and the tool-holder of screw machines. In the past, it has been necessary for users to cut off part of the shank and even part of the threaded portion of standard hand taps in order to fit them into screw machines, or else to order higher-priced special taps.

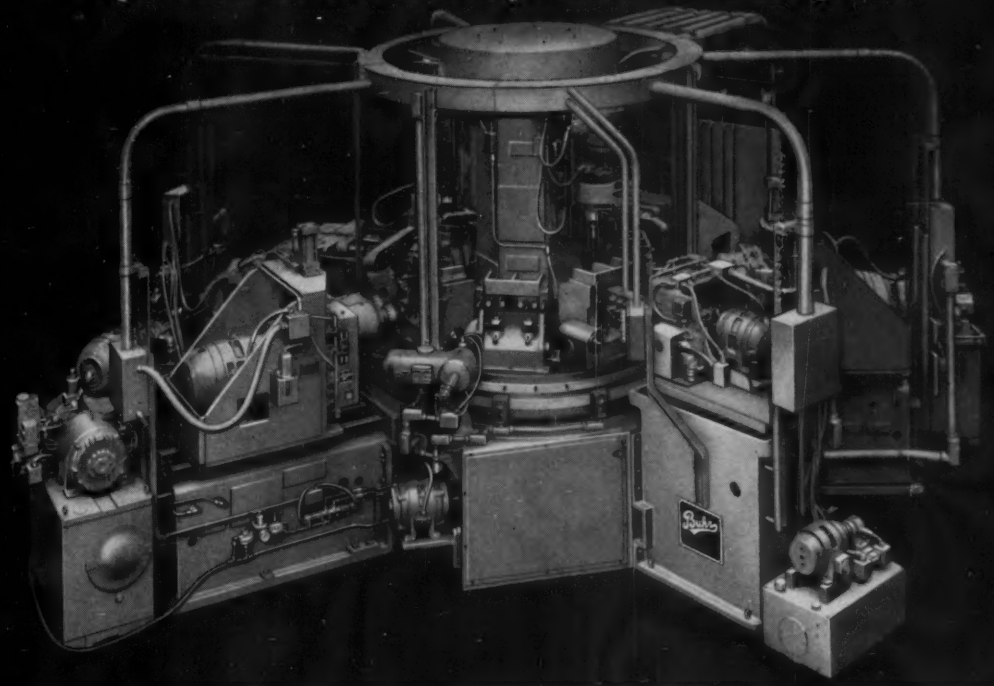
The shank of a stub tap is the same size as its nominal outside diameter. This permits standard-sized bushings to be used, and thus reduces bushing inventory problems. The full diameter shank has the advantage of providing greater strength than hand taps with turned-down shanks. The shorter or stub taps are available at no extra cost. They are made in fractional sizes from 1/4 inch through 1 inch and in machine-screw sizes from No. 0 through No. 14.

Circle Item 155 on postcard, page 277

ANOTHER EXAMPLE of
REDUCING COSTS WITH—

Buhr ECONOMATION

Mills, core-drills, drills, semi-finish bores, chamfers and taps 288 master-brake cylinders an hour gross!



Rough castings are loaded in pairs in this 10-way 7-station hydraulic-feed center-column Machine.

Equipped with 72″-diameter 7-position automatic power-driven heavy-duty index table, complete with two shot bolts.

For extreme ease of servicing and maintenance, automatic indexing unit slides out *without removing table.* This is done simply by detaching cover on front of Machine.

Other features of Machine include automatic hold-down clamp at rough-and-finish milling station, automatic rotating chip conveyor, power clamping and automatic lubrication.

Buhr
MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

Let us show you how Buhr Economation can reduce your production costs. A phone call, wire or letter will bring you a prompt consultation with one of our top sales executives.

BUHR MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers

"Core-Vent" Carbide Masonry Drill

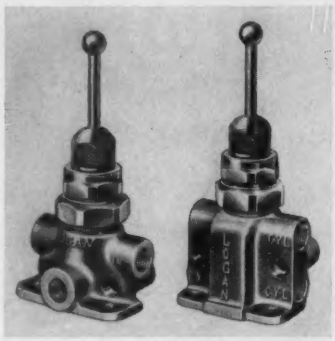
Carbide masonry drill of improved design, known as the "Core-Vent," announced by the Super Tool Co., Detroit, Mich. Made in sizes from 1/4 inch to 6 inches in diameter. Sizes over 5/8 inch in diameter have removable shanks. The 1-inch size drill will easily penetrate 4 inches of concrete and stone aggregate in less than fifty seconds, removing a core and leaving a clean, accurately sized hole for rapid installation of anchors, expansion shields, and similar fastening members.

Circle Item 156 on postcard, page 277

Vickers Gasket-Mounted Pressure Switch

Gasket-mounted pressure switch announced by Vickers, Inc., Detroit, Mich. This switch is designed to facilitate installation, maintenance, and replacement when applied to hydraulic presses, production and processing machinery, machine tools and other similar industrial oil-hydraulic equipment. This Series SG1-02 pressure switch is available in three models for wide pressure range coverage—100 to 1000, 100 to 2000, and 500 to 5000 pounds per square inch. Pressure settings for each model are adjustable throughout its complete range. Nominal current ratings range from 10 amperes at 110 to 125 volts alternating-current for the 100 to 1000 pounds per square inch size, 5 amperes at 220 to 250 volts alternating-current for the 100 to 2000 pounds per square inch size and 3 amperes at 440 to 460 volts alternating-current for the 500 to 5000 pounds per square inch size.

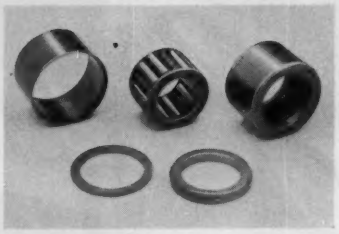
Circle Item 157 on postcard, page 277



Logansport Air Control Valves

Air control valves with locking toggle announced by the Logansport Machine Co., Inc., Logansport, Ind. This Model 6664 two-way valve designed for control of bleeder and pilot-operated master valves can be used as a three-way valve by removing plug in lower (center) port. The hand-operated toggle lever can be moved in any direction from the vertical to the angular locking position, from which it returns to the vertical position when manually released. This valve is designed for side or base mounting. It has a 1/4-inch port. Dual control two-way Model 6665 is similar to Model 6664 but has two exhaust openings which permit bleeding both ends of master valve alternately. This provides automatic reversal when toggle lever is returned to normal (vertical) position. Model 6676 is a four-way, two-position valve with locking toggle lever; side or base mounting and is designed for manual control of double-acting air cylinders.

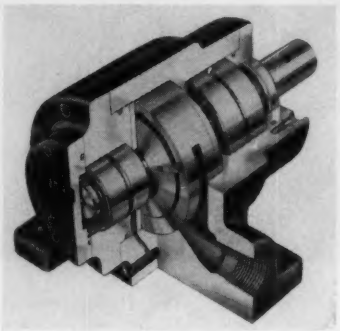
Circle Item 158 on postcard, page 277



Rollway Self-Contained Roller Bearing

Versatile self-contained cartridge type roller bearing designed for easy installation, just introduced by Rollway Bearing Co., Inc., Syracuse, N. Y. This new bearing unit consists of an outer race, roller assembly, retaining disc and seal. Besides substituting for plain bushings, it can be used in caster and wheel housings, and in gearboxes or gear drives. Available to fit 1/2- to 1 5/8-inch shafts and 1 1/8- to 2 1/2-inch housing bores. Various sized roller assemblies to suit specific load and housing requirements may be interchanged without altering the outside diameter of the outer race. The bearing is available with or without a lubrication hole in the outer race.

Circle Item 159 on postcard, page 277

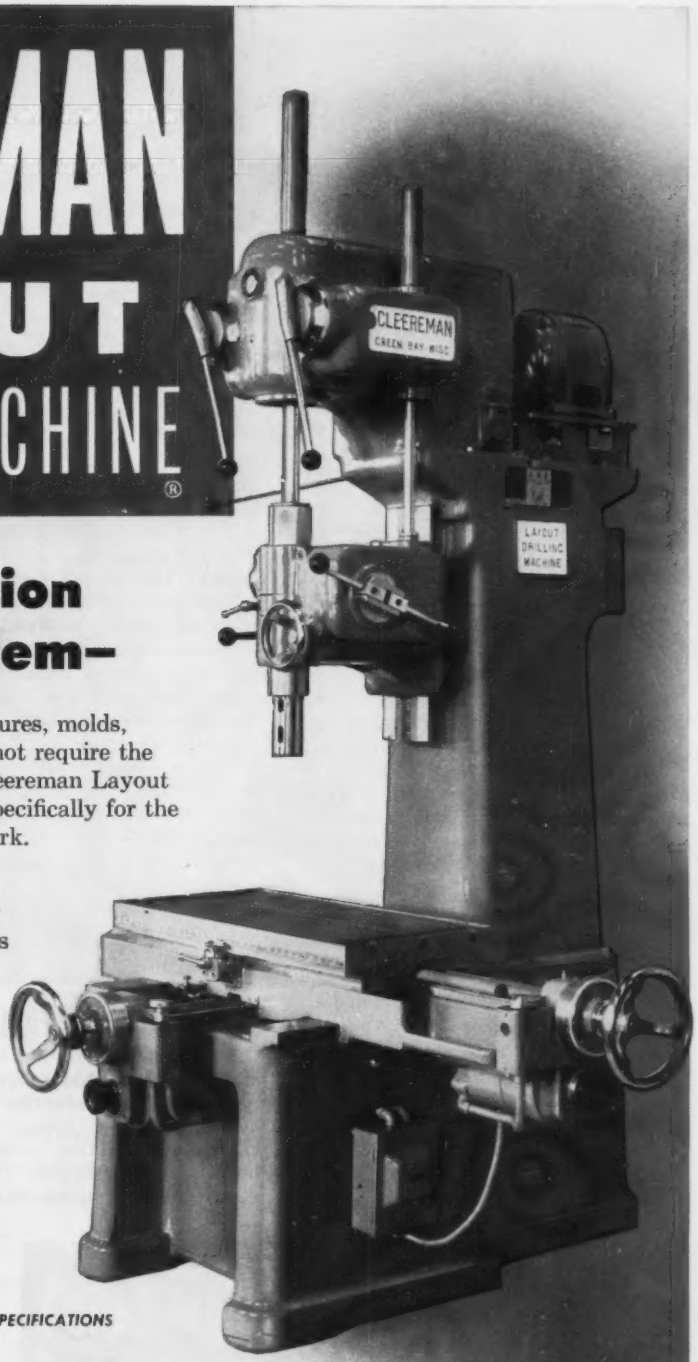


Fluid Motor Designed for Continuous Operation

Vane type, constant-displacement, fluid motor designed for continuous operation at pressures up to 1500 pounds per square inch and speeds as high as 3500 R.P.M., announced by Racine Hydraulics & Machinery, Inc., Racine, Wis. The bearings of this motor are designed to withstand heavy overhung loads. Fluid slippage at the stalling point is less than 10 cubic inches per minute at a pressure of 1500 pounds per square inch. The maximum output is 13 H.P.

Circle Item 160 on postcard, page 277

CLEEREMAN LAYOUT DRILLING MACHINE®



A Modern solution to an Old Problem–

A large portion of tools, dies, jigs, fixtures, molds, jig-less production and other jobs do not require the ultra-precision of a Jig Borer. The Cleereman Layout Drilling Machine has been designed specifically for the efficient handling of this particular work.

Built with many features of design similar to those used in Cleereman Jig Borers, the Layout Drilling Machine is an economical machine capable of accurately locating, drilling, boring, reaming, tapping, etc., with the utmost of operator ease, at a fast rate of production over a long period of time.

Cleereman standards of high quality and proven engineering design and material selection have been maintained in every detail.

WIRE OR WRITE FOR CATALOG WITH COMPLETE SPECIFICATIONS

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Representatives in Principal Cities

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CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

Between Grinds

By E. S. Salichs

Piece Positive

There is a story behind the story of "Chem-mill," a feature article in this month's issue of MACHINERY (page 156). The engineer who developed the process at North American Aviation took a piece that he had produced by this revolutionary method to a man in the shop and asked him to make a similar part for him. The man's reply was "That just can't be done. It's impossible." Then as he examined the part in his hand, he realized the contradiction. It had been done.

With Automatic Results

While introducing some business machines to the public, a certain corporation urged visitors to write a given word on a new electric typewriter. The reward for performing this simple task correctly was a martini ingeniously poured from a mechanized cocktail shaker and served to the winner.

Novel Advice

The best-seller *Sincerely, Willis Wayde* (by John P. Marquand) has as its background a New England belting mill. The plant engineer gives some constructive advice to his son, Willis, hero of the book, who at college age is in love with Bess, granddaughter of the belting big-wig, although he has only casual meetings with her. Says the father, "See some girls in your own group—not girls like Bess. What I mean are reciprocating girls . . . . I'm using a mechanical term, but I mean girls who are able to give you back the same that you give them."

Antiseptic Advertising?

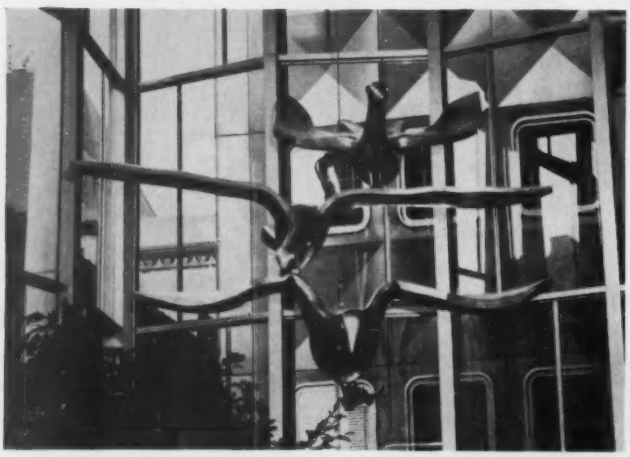
Renner Advertisers, with a staff of about 135 people handling industrial advertising, recently moved to new offices in the Renner Building, a converted hospital in Philadelphia. The copy department occupies what was the operating room; the art department, the maternity ward, and so on. During vacations, a skeleton force will operate.

Right from the Press's Mouth

How to service Bliss power presses is the theme of a movie taken in Bliss plants. In twenty-five minutes, viewers can see for themselves maintenance requirements for each component of a Bliss inclinable press and learn how to use the Bliss Spare Parts Suggestion Book to build an inventory of replacement parts.

Suitable Souvenir

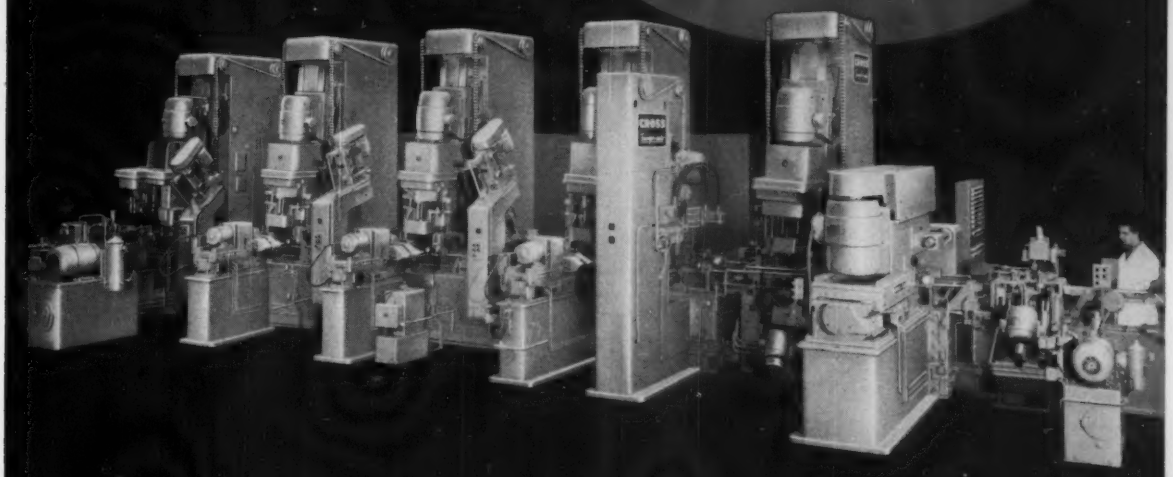
When the Thomas & Betts Co., Elizabeth, N. J., changed from malleable iron electrical conduit bushings to steel bushings of advanced design, the company presented Mary Laschuk with the last malleable bushing. She had reamed and tapped over 206,000,000 of them but none quite like this one—gold-plated and set with an amethyst.



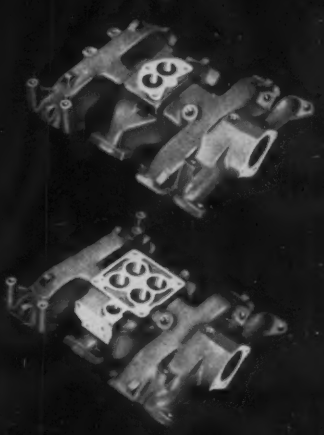
Metal Feathers—Three aluminum birds, over-all measuring 14 feet long, 12 feet from wing tip to wing tip, and about 5 feet high, have been suspended from the ceiling in the Alcoa Building at Pittsburgh. The art work, termed "Birds in Flight," weighs about 700 pounds, and is said to represent the lightness and versatility of aluminum.

Another Transfer-matic by Cross

Mills, Drills, Bores, Taps, 2 and 4 Barrel Intake Manifolds



- ★ Rough and finish mills carburetor pad; mills choke pad (4 barrel only); bores carburetor port holes; drills and chamfers all holes (except 3 holes in water outlet pad); and taps all holes.
- ★ 140 pieces per hour at 100% efficiency.
- ★ Initial part location from port openings.
- ★ Push-button changeover from 2 to 4 barrel carburetor.
- ★ 13 stations; 1 loading, 11 working, 1 unloading.
- ★ Lift-and-carry type transfer mechanism.
- ★ Pre-set tooling throughout.
- ★ Other features: construction to J.I.C. standards; complete interchangeability of all standard and special parts for easy maintenance; hardened and ground ways; drag chain type chip conveyor.



Established 1898

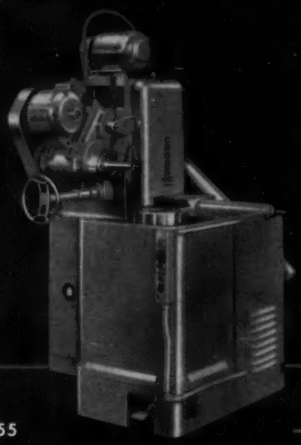
THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

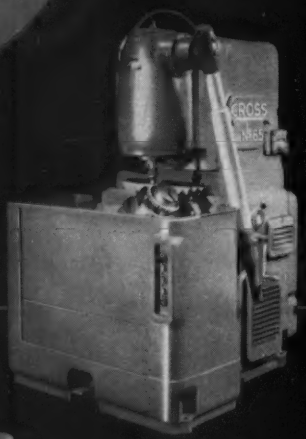
for rounding • chamfering • pointing • burring

Greater Flexibility with Cross Gear Machines



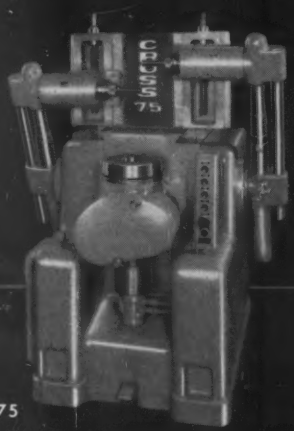
NO. 55

For rounding, pointing, chamfering or burring external and internal—
spur gears • helical gears
clutches • splines
Typical production—rounding or pointing 8 pitch 30 tooth gears—55 net hourly.



NO. 65

For pointing or chamfering external and internal—
clutches • spur gears
bevel gears • splines
Typical production—pointing 10 pitch 30 tooth gears—100 net hourly.



NO. 75

For burring or chamfering both ends at the same time—
helical gears • spiral bevel pinions
hypoid pinions
Typical production—chamfering 8 pitch 40 tooth gears—200 net hourly.

- ★ Flexibility for handling a wide variety of gears.
- ★ Rugged, heavy duty construction for continuous high production or job shop operation.
- ★ Short setup time (as little as 15 minutes) for changing from one gear to another.
- ★ Simple, inexpensive tooling.
- ★ Push button controlled automatic cycle.
- ★ Hydraulic power work clamping.

For mass production or short run jobbing operations, there is a Cross Gear Machine to suit your requirements.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 277

News OF THE INDUSTRY

California

NORTON CO., Worcester, Mass., announces plans for a new plant for the manufacture of grinding wheels in Santa Clara, Calif. It is expected to be completed by next January. Renovating and equipping the plant will cost about $1,000.000. GEORGE A. GARRISON has been named plant manager. Mr. Garrison, who joined the company in 1946, was formerly superintendent of packing and shipping at the Worcester plant.

LAMSON CORPORATION, Syracuse, N. Y., announces changes in personnel at its San Francisco branch plant: T. B. STURGIS has been appointed regional manager for the ten western states; A. S. ASQUITH has been made assistant West Coast regional manager; and ALLEN P. COOK and C. DON MCNUTT have been appointed field engineers.

Illinois, Indiana, and Missouri

FRANCIS B. MAKENS has been appointed general superintendent of the Chicago plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. He began his career with the company in 1936 and was advanced to operating superintendent in 1953, remaining in that position until his present appointment.

Francis B. Makens, general superintendent of Joseph T. Ryerson & Son, Inc.

ACME INDUSTRIAL CO., Chicago, Ill., announces its recent acquisition of an additional 38,000 square feet of adjoining floor space which has been remodeled to suit Acme's manufacturing requirements. The company has introduced a new line of over-sized steel dowel pins for repair work on doweled parts.

SCHNEIDER MFG. CORPORATION, Muncie, Ind., a wholly-owned subsidiary of the Westinghouse Electric Corporation, Pittsburgh, Pa., has been dissolved to form the hydraulic drives department of the Westinghouse Gear Division. The hydraulic drives department will sell, engineer, and manufacture hydraulic torque converters and associated brakes and transmissions. Headquarters of the department will remain at Muncie, Ind. Key appointments announced for the new department are as follows: S. M. JOHNS, sales manager; T. P. DUNKIN, manager of manufacturing; and P. L. FOSBURG, engineering manager.

CUMMINS ENGINE CO., INC., Columbus, Ind., announces the following recent promotions: E. D. TULL is executive vice-president; R. B. STONER is vice-president of personnel; C. R. BOLL is vice-president of sales; and P. J. EVERY is general sales manager.

W. L. WILKINSON has been appointed sales manager of W. C. Twigg Industries, Inc., Brazil, Ind.

PRODUCTO MACHINE CO., Bridgeport, Conn., in conjunction with the BOSSERT CO., Kansas City, Mo., has opened an assembly warehouse in Kansas City at 17 and Main Streets. It will service distributors in Tulsa, Phoenix, Denver, Dallas, Omaha, and Oklahoma City.

AMERICAN THERMOMETER DIVISION of Robertshaw-Fulton Controls Co., St. Louis, Mo., has been redesignated the AMERICAN CONTROLS DIVISION.

Michigan

VICKERS INCORPORATED, Detroit, Mich., is planning construction of a new engineering and administration building which will be located on a 70-acre site in suburban Detroit. The 150,000-square-foot building will house engineering facilities as well as some executive and sales offices. Occupancy is anticipated by early 1956.

William G. Findlay, who was made manager of the Detroit, Mich., steel service plant of Joseph T. Ryerson & Son, Inc.

WILLIAM G. FINDLAY has been appointed manager of the Detroit, Mich., steel service plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. He joined the company in 1922 and succeeds EMROY M. VEHMEYER, who has retired after forty-six years with the company.

MICROMETRICAL MFG. CO., Ann Arbor, Mich., has appointed the following firms as Profilometer representatives: SERVICE TOOL & ENGINEERING CO., Minneapolis, Minn., for North Dakota, most of South Dakota, Minnesota, and northern Wisconsin; FUCHS MACHINERY & SUPPLY CO., Omaha, Neb., covering Nebraska, western Iowa, Kansas, and western Missouri; MARSHALL SUPPLY & EQUIPMENT CO., Tulsa, Okla., covering Oklahoma and western Arkansas; STANCO CO., Dallas, Tex., covering Texas and Louisiana.

GEAR GRINDING MACHINE CO., Detroit, Mich., has constructed an addition to its plant for its Machine Tool Division which has expanded to cover the production of a new single-spindle screw machine.

CHARLES C. LAYMAN has been appointed vice-president of sales and engineering for Turner Bros., Inc., Detroit, Mich. He was formerly sales manager. STEPHEN T. MORELAND has been made director of engineering.

L. B. Mytinger, sales manager, Turchan Follower Machine Co.

L. B. MYTINGER has been made sales manager of the Turchan Follower Machine Co., Detroit, Mich. Mr. Mytinger has been in machine tool sales for over eight years.

New England

GILBERT T. COOVERT, general manager of the V & O Press Co., division of Emhart Mfg. Co., Hudson, N. Y., has also been named general manager of Emhart's Henry & Wright Division in Hartford, Conn. Mr. Coovert, who joined the Hudson firm in 1950 as personnel director, was appointed acting factory manager in 1951; in 1952, he was promoted to assistant general manager, and then was made general manager. V & O builds and equips precision power presses, while Henry & Wright produces automatic die machines and attachments.

PRODUCTO MACHINE CO., Bridgeport, Conn., manufacturers of die sets, die accessories, and machine tools, announces that its $750,000 expansion and modernization program is nearing completion.

FOXBORO CO., Foxboro, Mass., announces the following appointments augmenting the sales management staff: C. C. FULLER as vice-president; H. O. EHRISMAN as general sales manager; J. J. BURNETT as field sales manager; C. SCHWARZLER, who continues to direct the company's international operations; vice-president C. E. SULLIVAN, who has retired from active sales direction, is serving in a consulting capacity.

RUSSELL T. LOWE has been appointed assistant chief engineer of the Barry Corporation, Watertown, Mass. He will be responsible for all operating functions of the engineering department, including product development and design.

DONALD R. FEGLEY has been appointed chief engineer of Reed-Prentice Corporation, Worcester, Mass., an affiliate of Package Machinery Co., Springfield, Mass.

NICHOLSON FILE CO., Providence, R. I., announces the following executive appointments: EDMOND A. NEAL has been elected vice-president of

Fabian Bachrach

Edmond A. Neal, vice-president of domestic sales, Nicholson File Co.

domestic sales; STANLEY LIVINGSTON, JR., has been elected vice-president of operations; and CHARLES E. FOGG vice-president and secretary.

New York and New Jersey

J. H. WILLIAMS & CO., Buffalo, N. Y., announces the following appointments: DALE BETHKE has been made Chicago district manager. Mr. Bethke will make his headquarters at the company's district office and warehouse at 117 N. Jefferson St., Chicago, Ill. MARSHALL H. DURSTON has been made sales representative for Michigan. Mr. Durston's headquarters will be in the Detroit area. JOHN W. MURRAY has been made sales representative in western Pennsylvania, West Virginia, southeast Ohio, and northeast Kentucky.

GENERAL ELECTRIC CO., Schenectady N. Y. has named three new welding distributors to handle sales and service of the company's line of arc welders, electrodes, and accessories: Weld-Arc Sales & Supplies, Inc., New York City, operating in New York State from Poughkeepsie to New Jersey; Interstate Welding Supply Corporation, Elizabeth, N. J., covering northern New Jersey, Staten Island, and Manhattan; and T. H. Green Co., Rochester, N. Y., servicing the area including Livingston, Monroe, Ontario, Wayne and Yates counties in upstate New York.

Augustus B. Kinzel, vice-president of research of Union Carbide and Carbon Corporation

AUGUSTUS B. KINZEL has been elected vice-president of research of Union Carbide and Carbon Corporation, New York City. Doctor Kinzel has been engaged in research work with the company since 1926. He was appointed director of research in 1954. He succeeds Dr. George O. Curme, Jr., who is retiring as vice-president of the corporation. Doctor Curme will continue as a director.

THE CARBORUNDUM COMPANY, Niagara Falls, N. Y. announces the establishment of the Ceramic Fiber Project as a new operating unit of the company. The unit will manufacture high-temperature fiber finer than human hair. OTTO R. STACH has been appointed project manager. Prior to his new appointment, Mr. Stach was assistant technical sales manager of Refractories Division.

M. NIELSEN, vice-president of the Babcock & Wilcox Co., New York City, has been elected to the newly created post of executive vice-president. He joined the company in 1924. L. S. WILCOXSON, who has been vice-president in charge of research since 1945, has been appointed vice-president in charge of the Boiler Division. Mr. Wilcoxson joined the company in 1926.

LYNN G. WHITE has been appointed sales manager of the Toolset Division of General Riveters, Inc., Buffalo, N. Y. He was formerly office manager for the company.

ELBERT R. FAUST has been elected vice-president in charge of manufacturing of the Waterman Pen Co., New York City.

ALLOY TUBE DIVISION, Carpenter Steel Co., N. J., has been moved from Newark, N. J., to its home office and mill in Union, N. J. PAUL E. KELLY will continue in his capacity of eastern regional sales manager.

You Can Bet Your Bottom Dollar...

G.S. GEARS CAN CUT YOUR COSTS!

When rejects reach new lows and your assemblies roll without a hitch, *that's when costs come down.*

UNIFORM accuracy is a specialty here at G.S. It's that "priceless ingredient" in Small Gearing that means so much to the critical customers we serve. It's an achievement realized through 39 years of developing methods and machines to a degree of perfection unapproached in the history of the industry!

Now, with our greatly enlarged facilities, G. S. customers get even better Gearing with greater speed and efficiency than ever! More and more manufacturers from coast-to-coast are turning to G. S. for Small Gearing that improves performance and cuts costs. Chances are we can help you, too. Just tell us what you need. Friendly G. S. engineers will lend you every possible cooperation.

GET G.S. TECHNICAL DATA *Free!*

See where and how we mass-manufacture Small Gearing to uniformly fine tolerances. Folder contains 23 pictures of Small Gears, plant views, as well as Diametral and Circular Pitch Tables. Ask for your copy on company stationery, please!

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SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS
OF FRACTIONAL HORSEPOWER GEARING

G. T. Flammia, vice-president and general manager of Sossner Tap & Tool Corporation

G. T. FLAMMIA has been elected vice-president and general manager of the Sossner Tap & Tool Corporation, Lynbrook, N. Y. Mr. Flammia will be in charge of production activities in both the Tap and Gage Divisions of the plant.

LARS E. EKHOLM has been made manager of the Sales Division of Climax Molybdenum Co., New York City. He has been associated with the company since 1946.

THEODORE C. OHART has been appointed manager of marketing of the silicone products department of the General Electric Co., Waterford, N. Y.

CLARE F. SALTZ has been appointed manager of the Ordnance Equipment Division of the U. S. Hoffman Machinery Corporation, New York City.

LOUIS SRYBNIK has been made director of the Special Products Division of the S & S Machinery Co., Brooklyn, N. Y.

EDGCOMB STEEL & ALUMINUM CORPORATION, Hillside, N. J., announces the following executive changes: GEORGE L. TILLSON has been made chairman of the board and chief executive officer of the corporation; and HARRY L. EDGCOMB has been elected president.

PEARSE-DENGEL TOOL CO., Hasbrouck Heights, N. J., has been appointed local distributors for the Beaver Tool and Engineering Corporation, Royal Oak, Mich.

North Carolina, South Carolina, and Texas

SEALUBE CO., Wakefield, Mass., has appointed the LIVINGSTONE COATING CORPORATION, Charlotte, N. C. as its southeastern distributor. The company will service territory including Virginia, North and South Carolina, Tennessee, Georgia, Alabama, and Florida.

COOPER ALLOY CORPORATION, Hillside, N. J., announces the appointment of the Cameron & Barkley Co., Charleston, S. C., as distributors for their stainless-steel valves, fittings, and accessories.

FIRTH STERLING, INC., Pittsburgh, Pa., has moved their Southwest District Office from the Prudential Building in Houston, Texas to the plant located at 831 South 75th Street in Houston.

HARVEY ALUMINUM, Torrance, Calif., announces that its Dallas, Tex., field engineering office has been moved to 3918 Harry Hines Blvd. in Dallas. Art Bauer is district sales engineer in charge of the Texas area.

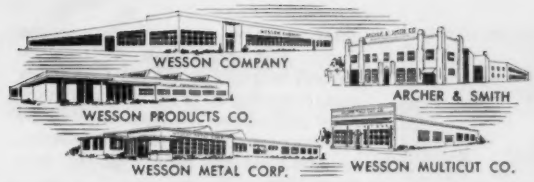
Ohio

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, announces that EDWARD E. HELM, the company's sales vice-president, has been assigned the duties of coordinator of all activities in merging the efforts of the recently acquired Reeves Pulley Co., Division with other divisions of Reliance in Cleveland and Ashtabula, Ohio. Reeves at Columbus, Ohio, will continue to operate as a division with CARL REEVES as president. FRANK B. CARR has been transferred to the Reeves Division as resident coordinator. Assignments in the sales organization are as follows: Sales Engineers REGINALD C. MARCHANT and THOMAS J. LISY have been transferred to the Rockford, and Chicago sales offices respectively; while GERALD A. JAKES and RICHARD W. PALMER have received sales engineering assignments in Toledo and Pittsburgh sales offices respectively.

E. W. BLISS CO., Canton, Ohio, has acquired the assets of the Mackintosh-Hemphill Co., manufacturer of complete iron and steel roll making facilities at Pittsburgh and Midland, Pa. It now becomes a division of Bliss. No changes in existing operations or personnel are contemplated.

LINCOLN ELECTRIC CO., Cleveland, Ohio, announces the following appointments: L. K. STRINGHAM has been elected vice-president in charge of engineering. Mr. Stringham, who joined the engineering department in 1933, has been chief engineer since 1951, and is a member of the board of directors. GEORGE LANDIS has been appointed vice-president in charge of research. NORMAN J. HOENIE has been appointed chief engineer of the Machine Division. EMMETT SMITH has been appointed chief engineer of the Electrode Division.

(Left to right) L. K. Stringham, vice-president in charge of engineering of Lincoln Electric Co., Norman J. Hoenie, chief engineer, Machine Division; Emmett Smith, chief engineer, Electrode Division



carbide NEWS

New Wessonmetal "26" Boosts Tool Life 40%

Optimum performance of "nearly universal" grade extends over range of 100 to 400 sfm

Gains in tool life ranging up to 40% over other steel cutting grades are reported for Wesson Metal Corporation's new Grade 26. The new steel cutting carbide has consistently outperformed all other steel cutting grades in 95% of all machining operations on which it has been applied.

Indications now are that the new Grade will produce significant increases in tool life over approximately 80% of the entire steel machining range. While created primarily to handle all types of steel rough and semi-finish machining—light, medium and heavy duty—it also is proving highly effective on some finishing operations.

What is more, the new Wessonmetal grade is not limited to a narrow range of cutting speeds. Optimum performance for Grade 26 extends over a range of 100 to about 400 sfm, covering 95% of steel machining operations encountered in industry today.

Since Grade 26 is the closest approach to a "universal" carbide for steel cutting yet produced, it reduces the number of grades required for steel cutting operations by as many as four grades. Problems of grade selection are greatly simplified, therefore, by the new Wessonmetal grade.

Much of Grade 26's outstanding performance is due to its superior cutting edge strength. Particularly important at the elevated temperatures generated at high cutting speeds, are the carbide's inherently high red hardness combined with high thermal conductivity.

Grade 26 is now in full production at Wesson Metal Corporation's new metals plant in Lexington, Ky.

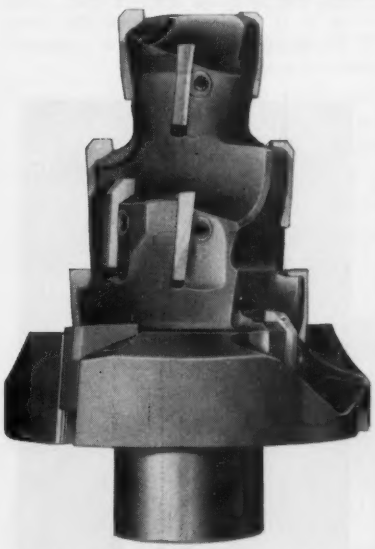
Tool life took a big jump on this severe interrupted cut on a forged steel tractor brake band anchor. Cutting speed ranges from 280 sfm down to zero. Feed is .027", depth of cut is ⅛".

Multi-Diameter Cutters Slash Tool and Machining Costs

Special eight-operation cutters designed by Wesson Company engineers permit a major builder of commercial air conditioning units to achieve a sizable reduction in the cost of machining compressors.

Solid Wessonmetal Grade GS blades are used on the cutters to produce 3600 cylinders per grind, compared with only 250 cylinders per grind previously. Grinding takes one-third as long as on tools previously used.

Although solid carbide blades are used on this operation, these special multi-diameter cutters are typical of the many other special Wesson designs incorporating standard blades which provide interchangeability of solid carbide, carbide tipped or HSS blades without modifying blade slots.



A total of eight chamfering, semifinishing, finish boring and facing operations are performed at each of five stations with these cutters on a W. F. & John Barnes boring machine.

tools Wesson carbide Wessonmetal

For answers to your machining problems write:

WESSON COMPANY, DEPT. AD, 1220 Woodward Heights Blvd., Detroit 20, Michigan

John P. Bernard, executive vice-president, Sheffield Corporation

Donald M. Pattison, president and general manager, T. R. Almond Mfg. Co.

SHEFFIELD CORPORATION, Dayton, Ohio, announces the formation of five production divisions and the appointment of the following general managers: VICTOR BOLL, Contract Services; JACK WELCH, Machine Tool —Murchey & Cavitron; WILLIAM I. WILT, Standard Production Instruments; W. FAY ALLER, Research; BENTON D. WITEMEYER, Fixed Gages & Inspection Room Instruments. The five divisional managers will report to JOHN P. BERNARD, executive vice-president.

WALTER C. BERGSTROM has been elected president of the Weldon Tool Co., Cleveland, Ohio. He succeeds his father, CARL A. BERGSTROM, who has been made chairman of the board. PAUL R. HATCH has been elected executive vice-president. Mr. Hatch was formerly associated with the Brown & Sharpe Mfg. Co., Providence, R. I., as vice-president of sales.

HERBERT GLEITZ, president of the Marquette Metal Products Co., Cleveland, Ohio, has retired after thirty-five years with the firm he founded in 1920. He built the company into one of the best known concerns in the field of precision machining. Mr. Gleitz is succeeded by FRED E. HARRELL, who occupies the post of general manager.

WHITE MOTOR Co., Cleveland, Ohio, announces the formation of a Special Products Division to handle the development and manufacture of a diversified line of non-automotive products. KENNETH F. ODE has been appointed general manager of the new division.

LESTER A. EDWARDS has been made assistant sales manager of the Cincinnati Gear Co., Cincinnati, Ohio. Mr. Edwards has been with the firm since 1937 and has advanced through a number of different positions in production and sales.

T. R. ALMOND MFG. CO., of Ashburnham, Mass., has had its name and certain assets purchased by a new management which has moved the company to a plant near Cleveland, Ohio. DONALD M. PATTISON has been made president and general manager of the new company. He was formerly a director and vice-president in charge of sales of the Warner & Swasey Co. IRVING T. KNOTT has been appointed works manager.

Pennsylvania and Maryland

LINK-BELT CO., Chicago, Ill., announces the following appointments at their plant in Philadelphia, Pa: DWIGHT H. RENFREW has been made chief engineer. Since 1944, he has been general superintendent of the Philadelphia operations, and as chief engineer, he will oversee the design and application of products. He will be aided by HENRY G. KELLER and NORMAN A. VIRKLER, assistant chief engineers. WILLIAM A. MORLEY has been appointed general superintendent, and has been with the firm since 1929.

SALEM-BROSIUS, INC., Pittsburgh, Pa., announces its merger with the PHILLIPS CORPORATION, Carnegie, Pa., which will be operated as the Phillips Division of the Salem-Brosius, Inc. JOHN M. PHILLIPS, JR. has been named vice-president of the Division and assistant to the president of Salem-Brosius, Inc. JAMES M. PHILLIPS has been made manager of equipment sales.

DOUGLAS A. HOPPER has been named general manager of General Electric Company's welding department at York, Pa. Mr. Hopper succeeds RAYMOND C. FREEMAN, who has been appointed manager of engineering and operations of the atomic power equipment department at Schenectady, N. Y.

MACHINERY ASSOCIATES, INC., Wynnewood, Pa., has been appointed exclusive representative in Washington, D. C., for the Grinding Machine Division of Norton Co., Worcester, Mass. They will continue to represent Norton in the Philadelphia area.

JACK S. LOYND has been appointed to the newly created post of industrial relations counsel of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa.

H. L. CUMMINGS has been appointed general manager of the R-PC Valve Division, American Chain & Cable Co., Inc., Reading, Pa.

WILLIAM J. LEIGHTON has joined the Philadelphia district sales office of F. J. Stokes Machine Co., Inc., Philadelphia, Pa., as sales engineer.

(Left) Dwight H. Renfrew, chief engineer of the Philadelphia plant, Link-Belt Co.; (right) William A. Morley, general superintendent

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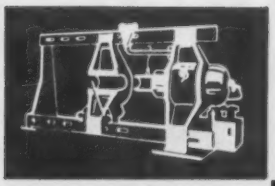
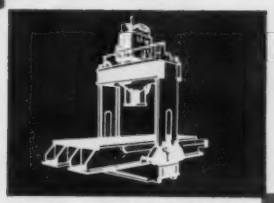
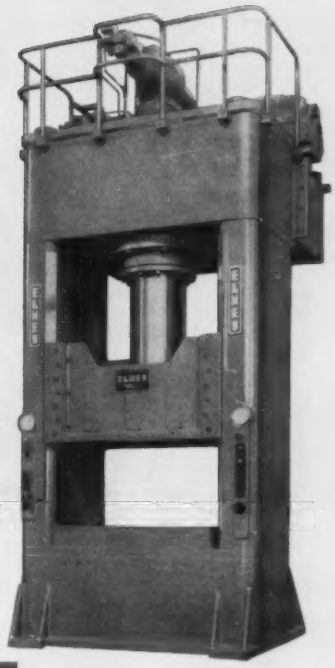
builds hydraulic metalworking presses to meet *your* production requirements—exactly



Inclined Forcing



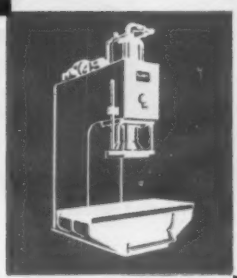
Traveling Head Straightening



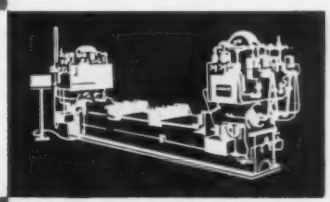
Drawing and Forming

If you're seeking improved and more economical press performance for your metalworking production, you can come with confidence to Elmes. Elmes builds a complete line of hydraulic presses for a broad range of metalworking jobs—for drawing and forming, coining, forging, hobbing, straightening, bending, forcing, powder metal compacting, etc. One of the many Elmes® standard press designs may fit your needs exactly. Or, if your requirements are special, you can rely upon Elmes "custom engineering" for the answer. Building presses to meet individual customer requirements is an important part of Elmes engineering service.

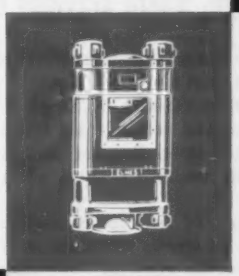
Elmes Presses are recognized throughout industry for their proven quality and dependability, backed by over a century of accumulated engineering experience. Whether your requirements are standard or special, it will pay you to contact your Elmes Distributor, or write direct. Recommendations and cost estimates supplied promptly without obligation.



Openside C-Frame



Tube Reducing



Hobbing

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MT

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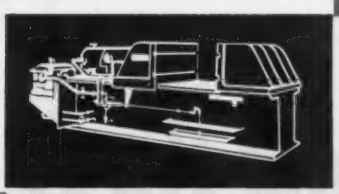

Horizontal Bulldozer

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1162 Tennessee Avenue...Cincinnati 29, Ohio

HYDRAULIC PRESSES & EQUIPMENT

METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS

POWERFUL Homelite Model 17 Chain saw being assembled in Homelite factory at Port Chester, N.Y.

ONLY 22 LBS., Model 17 Homelite Chain saw delivers 3.5 hp — power to spare for felling trees 4 feet in diameter. Cuts up, down, left or right; is easily carried up trees.

Girl assembles chain saw 30% faster with RB&W SPIN-LOCK screws

SPIN-LOCKS hold tight where previous fasteners let go

Usually production men turn to RB&W SPIN-LOCK screws because they need a fastener that won't lose its grip.

But Homelite Corporation of Port Chester, N.Y. got a lot more value than they expected when they tried SPIN-LOCKS on their famous chain saws. Regular screws plus washers had loosened rapidly under vibration when the saws went to work.

SPIN-LOCK cured this problem, of course. Homelite reports: *"We've had no loosening of screws when the saws get out in the woods."* And, Homelite goes on, *"We also found through time studies that we saved an average of 30% in time required to insert and drive the screws — giving us lower labor cost and faster assembly time."* What's more, *"The average cost of* SPIN-LOCKS *and regular screws plus washers is just about the same."* Measure of Homelite's satisfaction: the new Model 17 saw uses *79* SPIN-LOCKS in *16* types and sizes.

Whether you want a fastening device with a bull-dog grip or a way to lower assembly time and costs, an RB&W SPIN-LOCK screw could be the answer. It's easy to find out — just write the nearest RB&W office. RUSSELL, BURDSALL & WARD Bolt and Nut Co., Port Chester, N.Y. 4.11

Check Sweet's Design File for RB&W SPIN-LOCK Catalog

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On products shown in the advertisements

NEW CATALOGUES

SCREW MACHINE PRODUCTS—National Screw Machine Products Association, 2860 E. 130th St., Cleveland 20, Ohio. 18-page buyers' guide specifying screw machine products and covering such topics as: What increases Costs, Design Considerations, Samples, Drawings, Grinding, Burring, Concentricity, Plating and Heat Treating, Finishing, Inspection, Over-runs and Under-runs, Deliveries, Threads, Conditions of Sales, and Manufacturing Practices. More than one dozen engineering drawings illustrate various sections of the booklet. Information is arranged for quick reference. The guide is available upon business letterhead request direct to the above address.

FINISHES FOR ALUMINUM—Aluminum Company of America, 762 Alcoa Bldg., Pittsburgh 19, Pa. 48-page publication using full color photography and giving an outline of finishing methods and application of specific finishes to products and structures. The methods described include: mechanical finishes; commercial finishes; electrochemical finishes; electroplating; and paint, lacquer and enamel. Other characteristics which receive special mention in the book are reflection, durability, and surface hardness of aluminum finishes. This book may be obtained when requested on a company letterhead direct to the above address.

ABRASIVE BELT MACHINING—Engelberg Huller Co., 831 W. Fayette St., Syracuse, N. Y. 23-page catalogue describing in detail the application methods of the company's complete line of abrasive belt machines; and explaining the operation of five types of abrasive belt machining, pointing out savings in time, labor, spoilage, and space costs. This booklet is available upon business letterhead request direct to the above address.

VISUAL LAY-OUT EQUIPMENT—"Visual" Plant Layouts, Inc., Pennsylvania Ave. at River, Oakmont, Allegheny County, Pa. 50-page catalogue which describes three-dimensional planning materials and gives latest price list of "Visual" plant lay-out equipment numbering some 10,000 pieces. Can be obtained on company letterhead request direct to the above address.

POWDER METALLURGY—Amplex Division, Chrysler Corporation, Detroit, Mich. 52-page treatise on powder metallurgy entitled "Engineering Manual E-55," illustrated with photos, tables, charts, and graphs. Additional illustrated material is presented in the form of case histories giving information for both actual and potential users of metal powder parts. Separate sections are devoted to bearings, component parts, and filters. Other subjects include design, loads and speeds, installation, press-fit, close-in, shaft clearance, wall thickness, tolerances, temperature change, lubrication, machining, hardening, magnetic properties, and flow rates. Comparisons are made of the physical properties to ferrous and non-ferrous metal powder materials in the most common usages. Hypothetical problems are outlined and solved. 1

DRILLING AND REAMING—Whitman & Barnes Division of United Drill & Tool Corporation, Plymouth, Mich. 36-page booklet entitled "Drill and Reamer Facts" describing and illustrating the design and construction of twist drills, correct drill pointing, as well as general instructions on the proper use and care of drills and reamers. Recommended speeds and feeds, cutting compounds and types of drill point to use when drilling various materials are also given. The design, construction, use, and care of reamers, and cause of breakage, and excessive wear are also discussed. 2

WORK-HOLDING EQUIPMENT—Jergens Tool Specialty Co., Cleveland, Ohio. 64-page catalogue illustrating the complete line of the company's work-holding equipment in jig and fixture components. Engineering data is given on thousands of "in-stock" sizes or chuck-jaw blanks, handles, knobs, wheels, clamp assemblies, and components. Profusely illustrated, the publication specifies part sizes to the finest details. A simple ordering system has been incorporated to eliminate order errors. 3

SHELL-MOLDING MACHINE—Link-Belt Co., Chicago, Ill. 7-page pamphlet describing shell-molding system capable of producing up to 240 quality molds per hour for the foundry industry. This new system includes a four-station shell-molding machine for forming and curing mold-halves; a shell-closing machine for completing the shell-molding operations; and all process equipment from sand preparation to handling finished castings. The system has been proved in actual volume production. 4

CASTINGS—Meehanite Metal Corporation, New Rochelle, N. Y. Wall chart containing the complete design and engineering properties of the various types of the company's castings available to industry. It furnishes data on the general engineering, heat-, wear-, and corrosion-resisting types of Meehanite metals, and gives some basic facts about the metallurgy of castings, as well as graphs showing the effect of mass influence upon strength properties. 5

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MILLING CUTTERS—Goddard & Goddard Co., Detroit, Mich. Bulletin 121, describing unground multiple-thread milling cutters and their application in metal-working processes. Data is given on the latest multiple-thread milling cutter tolerances and classifications standardized by the Metal Cutting Tool Institute. Maintenance information is provided for sharpening both straight and spiral-gashed cutters, and inspection procedure for checking cutter rake is described and illustrated. **6**

PORTABLE OIL FILTERS—Hilliard Corporation, Elmira, N. Y. Bulletin 316, introducing the portable line of the company's oil filters and discussing oil maintenance ability and uses. References are provided for specific data and illustrations of some models. Information is also given on combination portable oil filters —oil reclaimer units for filtration and vacuum vaporation on turbines, Diesel and gas engines, transformers, and gear drives. **7**

AUTOMATIC CONTROLS—Assembly Products, Inc., Chesterland, Ohio. Bulletin G-7, describing a bearing temperature monitor which features internally shock-mounted and sealed-contact meter relays. Each bearing, or danger point, has its own thermocouple and indicator which shows continuously the running temperature. The trip point is individually adjustable from the front of each meter relay. Specifications and illustrations are included. **8**

METAL LATHES—Delta Power Tool Division of Rockwell Mfg. Co., Pittsburgh, Pa. 7-page booklet describing the company's new 11-inch metal-cutting lathe and complete line of engineered accessories. Design features of the tool are explained with the aid of photos and line drawings. Ten models in which the lathe is available are identified and described briefly, and specifications and standard equipment are listed in full. **9**

SELECTION AND APPLICATION OF CARBIDE METAL TOOLS—Carmet Division, Allegheny Ludlum Steel Corporation, Detroit, Mich. 20-page manual to aid users of Carmet cemented carbides in the selection, fabrication, and application of tools and blanks. Included in it are descriptions of the various grades, as well as instructions and drawings covering all operations and tool types. **10**

JOINING STAINLESS STEELS—Crucible Steel Company of America, Pittsburgh, Pa. 24-page booklet explaining in detail seventeen methods employed in joining stainless steel by fusion processes, including manual, automatic, and semi-automatic welding, brazing and soldering. A section describing eight-flame- and arc-welding procedures commonly used for severing stainless steels is included. **11**

CORROSION PREVENTION — Angier Sales Corporation, Framingham, Mass. 19-page booklet discussing vapor phase inhibitors and the chemical action that occurs to halt rusting of various metals and aluminum. The company, original licensee, by Shell Development Co. for manufacture of VPI papers, presents in the publication practically all aspects of VPI papers in the field of corrosion prevention. **12**

PRECISION SPINDLES—Standard Electrical Tool Co., Cincinnati, Ohio. Catalogue 20, featuring the company's new line of super-precision spindles for grinding, boring, drilling, milling, routing, and other kinds of work-heads. The publication covers details on machine tool attachments including slides, feeds, traverse and tables, and a group of illustrations of custom-built spindles for all types of industry. **13**

CYLINDERS WITH BUILT-IN VALVES—Carter Controls, Inc., Lansing, Ill. Bulletin 125, giving information on the power-pack air cylinder with built-in cartridge valve and speed controls. Over 1900 different mounting-size and control combinations are described. The bulletin gives all essential ordering information on rods, valving, port orientation, parts, and mounting styles. **14**

CUTTING TOOLS—Detroit Reamer & Tool Co., Detroit, Mich. 6-page bulletin illustrating and describing the uses and merits of subland tools. Advantages gained in using these tools are discussed to provide users with a basis for selection. The company has developed many multiple-purpose subland tools that, with each pass, perform a combination of operations. **15**

METAL-WORKING MACHINE—Kling Bros. Engineering Works, Chicago, Ill. Bulletin 100, consisting of 6 pages illustrates and describes the basic Kling models that represent over fifty different machines, which handle more than a score of metal fabricating operations. The bulletin also includes considerable technical data, such as construction features and tables. **16**

ROLL GRINDING WHEELS—Simonds Abrasive Co., Philadelphia, Pa. Bulletin ESA-237, featuring roll grinding wheels as used for re-grinding operation for steel mill rolls, paper mill rolls, and miscellaneous rolls. Included is a grain and grade recommendation table with special reference to alloy chilled iron-work rolls and steel back-up rolls for steel mill application. **17**

ELECTRIC CHAIN HOISTS—Chisholm-Moore Hoist Division, Columbus McKinnon Chain Corporation, Tonawanda, N.Y. Bulletin 158, containing 11 pages of information on Lodestar electric chain hoists and explaining features, design, construction, and performance. Specifications, illustrations, diagrams, and descriptions of models are included. . . **18**

HARDENING MACHINES—Cincinnati Milling Machine Co., Cincinnati, Ohio. Publication M-1861, describing the "Flamatic" hardening machine, including data on high-heating capacity, electronic control, and low-cost tooling. Special and standard types are discussed. There is also a section on allied equipment. Booklet contains diagrams and photos. . . **19**

CARBIDE - TIPPED CENTERS—Ready Tool Co., Bridgeport, Conn. Booklet illustrating company line of Red-E anti-friction, high-speed, and carbide-tipped centers. Data is also given relating to grinding- and milling-machine dogs, basic-bearing designs, interchangeable points for shank centers, extra heavy-duty bull nose and air-foil centers . . . **20**

LEAD-BEARING STEEL BARS—LaSalle Steel Co., Hammond, Ind., 4-page bulletin describing La-Led cold-finished steel

Product Information Service

Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.

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129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156
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bars which permit faster machining. Various sections of the bulletin give additional information on speed, efficiency, crimping, roll-threading, as well as chemistry, physical properties, and available sizes. **21**

MULTIPLE-THREAD MILLING CUTTERS—Star Cutter Co., Farmington, Mich. 4-page manual including tables listing tolerance standards of all commercial sizes of shell and shank type multiple-thread milling cutters. Tolerances are given for precision-ground, commercial-ground, accurate unground and commercial unground classes of cutters. **22**

HYDRAULIC CYLINDER DATA—Miller Fluid Power Co., Melrose Park, Ill. Bulletin H-104K, containing 8 pages of up-to-date data on the company's line of heavy-duty, 2000-pound-per-square-inch, high-pressure hydraulic cylinders in 1 1/2 through 12-inch bores, up to 22-foot strokes in nineteen different mounting styles. **23**

ELECTRO-PNEUMATIC FORGING HAMMERS—Lobdell United Division, United Engineering & Foundry Co., Wilmington, Del. Publication featuring Nazel electro-pneumatic hammers and describing operating principles of several types. Helpful information is given on the force of the blow of a hammer and control of the blow. **24**

TEMPERATURE INDICATING PRODUCTS—Tempil Corporation, New York City. Brochure denoting the choice of temperature indicating products for the intended application and listing the various temperature ratings available in each of the product types, including newly developed items in the 400 F. and 550 F. interval. **25**

GROUND THREAD TAPS—Pratt & Whitney Division of Niles-Bement-Pond Co., West Hartford, Conn. Bulletin T-583, containing 25 pages of information covering regular listed ground-thread taps, conversion tables, general dimension tables, revision of tap standards, tap recommendations, and thread-limit tables. **26**

BEARINGS—McGill Mfg. Co., Valparaiso, Ind. 140-page catalogue giving data on the company's complete line of bearings, including the new, sealed Guiderol bearings. There are 30 pages of general engineering information on ball and roller bearings, with charts, drawings and formulas for bearing load computation. **27**

AIR TOOLS—Ingersoll-Rand Co., New York City. Catalogue containing 52 pages of case histories describing Air Impactools for running nuts, bolts, cap-screws, and other type fasteners. Also included are illustrations, specifications, and information on the equipment furnished with each tool. **28**

HEAT-TREATMENT OF STEEL—Leeds & Northrup Co., Philadelphia, Pa. 20-page catalogue telling how Homocarb furnaces with Microcarb control are being used for case carburizing, carbon restoration, homogeneous carburizing, and hardening of steel products on a reproducible, mass-production basis. Installation facts and case histories are included. **29**

HOB LIST FOR GEAR USERS—Brad Foote Gear Works, Inc., Cicero, Ill. 56-page booklet, listing hobs, cutters, and broaches assembled by the company in producing custom-built production gears. The great variety of stock listed enables the concern to do almost any gear cutting job without additional tools. . . . **30**

CARBIDE GRADE CHART—Firth-Loach Metals, Inc., McKeesport, Pa. Carbide manufacturer's grade chart which includes "Firlomet," the new entry into the carbide field. The chart presents the manufacturer's recommendations for carbides for the use indicated, and is not intenled as a grade comparison chart. **31**

STAINLESS STEELS—G. O. Carlson, Inc., Thorndale, Pa. Folder describing stainless-steel products, equipment, and services of the company, and including illustrations of stainless-steel plates, circles and rings, heads, forged flanges and sketch plates, sheets (No. 1 finish), and forgings. **32**

BRASS PRODUCTS—Titan Metal Mfg. Co., Bellefonte, Pa. 20-page booklet describing the company's brass products and giving weight tables, specifications, and other technical data on free-cutting brass, commercial bronze, forging rods and shapes, brass wire, and boat shafting. **33**

PUNCHING PRESSES—Ferracute Machine Co., Bridgeton, N. J. Catalogue P-400, containing 4 pages of information on 150- and 200-ton model punching presses, and including illustrations and specifications. Friction clutch advantages are given, and features of single-geared presses are described in detail. . . . **34**

CARBON ALLOY STEEL—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin 14-6, describing the Rycut 50 alloy steel supplied in both annealed and quenched-and-tempered condition. Mechanical properties, hardening ability, analysis range, and applications are given. **35**

FLAW LOCATION—Turco Products, Inc., Los Angeles, Calif. Booklet entitled "Flaw Location by Dye Penetrants" describes in detail the Turco Dy-Chek inspection method and offers helpful suggestions on how to perform inspections on any metal by the penetrant method. **36**

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BRAZING, GRINDING, AND INSPECTING TOOLS—Adamas Carbide Corporation, Kenilworth, N. J. 4-page folder stating plainly the step-by-step procedures for brazing, grinding, and inspecting carbide-tipped tools. Tables of specifications and clearly drawn diagrams are featured. 37

STORING COATED ABRASIVES—Armour & Co., Coated Abrasives Division, Alliance, Ohio. 8-page illustrated booklet entitled "How to Store Coated Abrasives," describing temperature and humidity limits for proper storage and suggesting ideal storage room location . 38

THREAD-ROLLING ATTACHMENT—Landis Machine Co., Waynesboro, Pa. Bulletin G-96-1, giving detailed data on the five sizes of Lanroll attachments which can be applied to either automatic screw machines or lathes, and will produce coarse pitch threads to Class 4 tolerances. 39

TURRET PUNCH PRESSES—Wiedemann Machine Co., Philadelphia, Pa. Bulletin 101, containing information on turret punch presses and gage tables for material positioning and describing short-run piercing jobs. Twelve models are listed, and specifications are given. 40

CARBIDE BLANKS, TOOLS, AND INSERTS — Vascoloy-Ramet Corporation, Waukegan, Ill. Catalogue VR-442, containing 45 pages on the company's line of blanks, tools, and inserts and including prices as well as technical information on the proper grade selection. .. 41

ALUMINUM FORGINGS—Harvey Aluminum, Torrance, Calif. 12-page booklet describing press forgings, impact extrusions, and hand forgings. Also enumerated are the mechanical properties of aluminum forging alloys. Typical forging applications are summarized. 42

PRECISION TOOL KITS—S. J. Williams Precision Tool Kits, Inc., Schiller Park, Ill. 12-page booklet giving easy-to-follow drawings and full instructions for using "Doit" Urslf kits for magnetic parallels, V-blocks, sine blocks, and flat inspection blocks. 43

ENCLOSED MOTORS—U. S. Electrical Motors, Inc., Los Angeles, Calif. 12-page booklet giving data on the U. S. Type H Uniclosed motor. Color views illustrating various constructional features are included. The motor conforms with NEMA specifications. 44

LUBRICATION FOR MACHINE TOOLS—Trabon Engineering Corporation, Cleveland, Ohio. 4-page folder outlining automatic lubrication systems made by the company for use on machine tools. On-the-job applications and various lubricating system components are illustrated. 45

DOUBLE ECCENTRIC ADJUSTABLE DRILL HEAD—Thriftmaster Products Corporation, Lancaster, Pa. 4-page pamphlet describing the features of the company's double eccentric adjustable drill head, and giving specifications and photos of several models. 46

STANDARD CARBIDE TOOLS AND BLANKS—Adamas Carbide Corporation, Kenilworth, N. J. 16-page, price and specifications book describing the company's line of standard tools and blanks, and featuring "Throw-Away" insert blanks, each size in two thicknesses. 47

MACHINES FOR AUTOMATION—Ex-Cell-O Corporation, Detroit, Mich. 20-page brochure illustrating and describing typical examples of standard, transfer, and special machines equipped with mechanisms for automatic loading and unloading of work-pieces. 48

INDUCTION HEATING—Lepel High Frequency Laboratories, Inc., Woodside, N. Y. 4-page pamphlet discussing the principles of induction heating and practical applications. Two models of induction heat-treating units are shown with specifications. 49

PRECISION LATHES—Sheldon Machine Co., Inc., Chicago, Ill. 4-page circular describing the Sebastian 15-inch geared-head lathe. Complete specifications including capacities, design features, and accuracy tests are given. 50

VIBRATING REED TACHOMETERS—Herman H. Sticht Co., Inc., New York City, Bulletin 770, giving data on models of vibrating reed tachometers of various types. Pictures of models, specifications and dimensions are included. . 51

TAPS AND DIES—Winter Bros. Co., Rochester, Mich. Catalogue 22, containing 32 pages on balanced-action taps and dies, including general-purpose taps, and taps for special applications. Specifications are provided. 52

TILTING-ARBOR SAW—Boice-Crane Co., Toledo, Ohio. Leaflet describing the company's Master-Monotrol 10-inch tilting-arbor saw and describing its accuracy, capacity, simplified operation, and new speed factors. 53

DIES AND TOOLS—Lamina Dies & Tools, Inc., Royal Oak, Mich. 20-page brochure showing facilities, methods, and illustrations of progressive lamination and gear dies. Fixtures and special machines are also described 54

PIN-CLUTCH—Ferracute Machine Co., Bridgeton, N. J. Catalogue CL-1, listing component parts and giving operating instructions for positive single-stroke pin-clutch 55

BORE GAGE—Madison Industries, Inc., Muskegon, Mich. Leaflet featuring double- and single-end type adjustable Boregage 56

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15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168	169	170

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43	44	45	46	47	48	49	50	51	52	53	54	55	56
101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168	169	170

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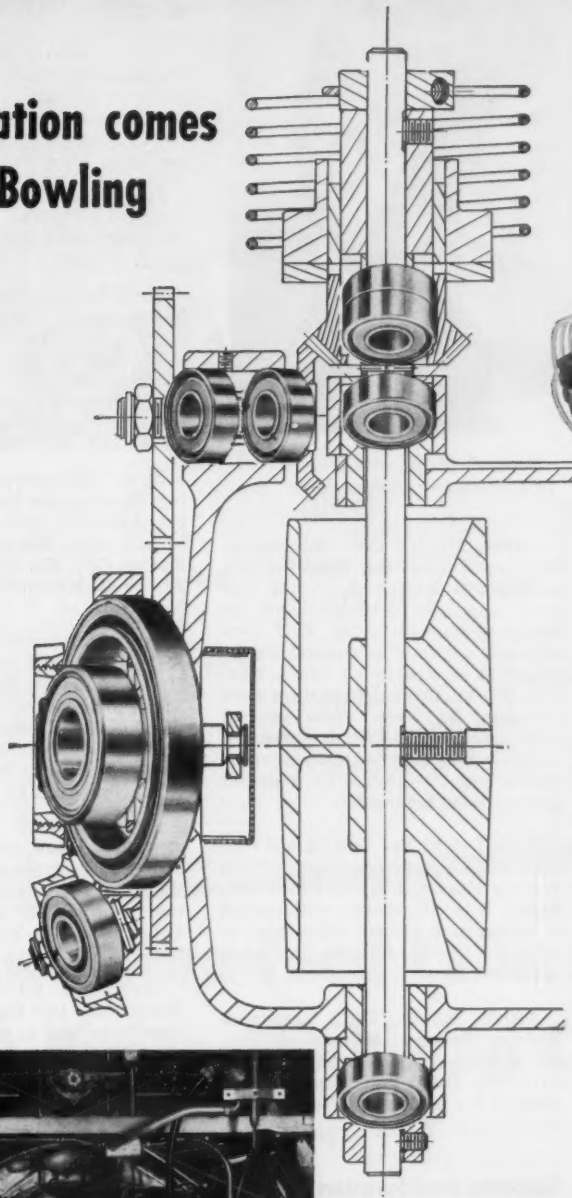
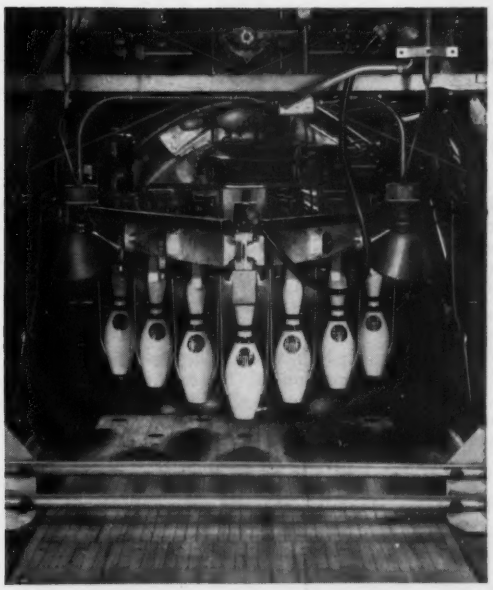
Turning Points to more Efficient "Pin Boys"!

Automation comes to Bowling

Section of Pin Distributor Drive Head Assembly equipped with six Fafnir Extra Small Series Double-Shielded Ball Bearings including a duplex arrangement plus a 200 Series Plya-Seal Bearing located in housing within an Aircraft Type Bearing . . . also another 200 Series Bearing with Plya-Seals.





AMF Automatic Pinspotter is shown in process of lowering pins.

Watch an American Machine & Foundry Company Pinspotter in operation sometime, and you'll agree that it's an outstanding example of automation. This ingenious machine performs a multiplicity of complicated operations with amazing smoothness and dependability.

Incorporated in many of the turning points of the Automatic Pinspotter are Fafnir Ball Bearings . . . forty of them in all. They include several sizes of the 200 Series, Inch Type, and Extra Small Series, all with double grease shields . . . also three different Aircraft Type Ball Bearings with double Plya-Seals and a Flangette. Effectively placed, these ball bearings permit precise coordination of motion unhampered by friction.

Here is another example of the Fafnir "attitude and aptitude" . . . a way of looking at bearing problems from the designer's viewpoint, plus coming up with the right bearing to fit the need. Automation problems and solutions are part of Fafnir's industry-wide experience. If you need the advantages of such experience, let Fafnir help you. The Fafnir Bearing Company, New Britain, Conn.

FAFNIR

BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

Edwin R. Broden, executive vice-president of SKF Industries, Inc.

James A. Arter, vice-president of manufacturing, Ampco Metal, Inc.

EDWIN R. BRODEN has been elected executive vice-president of SKF Industries, Inc., Philadelphia, Pa. He was formerly executive vice-president and a director of The Carborundum Company, Niagara Falls, N. Y.

PANGBORN CORPORATION, Hagerstown, Md., announces the following changes in sales personnel: CHARLES BULTMAN, Detroit district sales manager, has left that position for the field sales department; DAVID BAIR, who was assistant to Mr. Bultman for the past fourteen years, now succeeds him. ROBERT TREGLOWN has been made a sales engineer in the Detroit district; C. H. MCKINSEY has been promoted to sales engineer in the Detroit office; JAMES G. RICHESON has been appointed sales engineer and assistant to District Manager E. C. GILMOUR in St. Louis and Kansas City, Mo.

Wisconsin and Montana

GISHOLT MACHINE CO., Madison, Wis., announces the following executive appointments: FREDERICK L. CHAPMAN has been elected a vice-president. Mr. Chapman has also been made a member of the board of directors to succeed CLAUDE K. SWAFFORD, who retired earlier this year. GEORGE M. CLASS has also been elected a vice-president. Both men have been with the company for over twenty years.

JACK N. YETTER has been appointed sales manager of the General Products Division of the Twin Disc Clutch Co., Racine, Wis. Mr. Yetter succeeds E. C. BILLINGS, who has recently retired after serving with the company in an executive sales capacity for twenty years. Mr. Billings will continue to act in a consulting capacity.

AMPCO METAL, INC., Milwaukee, Wis., announces the following appointments: JAMES A. ARTER has been appointed vice-president in charge of manufacturing; E. E. JAGMIN will continue as general superintendent in charge of production; J. P. HENRY, formerly assistant sales manager, has been made general sales manager; and R. J. SEVERSON, formerly manager of technical sales, will assume the duties of assistant general sales manager.

JOHN DEWEY has been named Chicago branch sales manager of the Warner Electric Brake & Clutch Co., Beloit, Wis. His duties will consist in supervising branch office sales in northern Illinois, Indiana, and eastern Iowa.

AMPCO METAL, INC., Resistance Welding Division, Milwaukee, Wis., has appointed the GENERAL DISTRIBUTING CO., Great Falls, Mont., as distributor for the Ampco-Weld line for the state of Montana.

Canada and Sweden

COCKSHUTT AIRCRAFT, LTD., Renfrew, Ontario, Canada, has ceased operation, and the Aluminium Castings Co., Ltd., Glasgow, Scotland, has taken over control of the plant on behalf of their subsidiary Burnley Aircraft Products, Ltd., Burnley, England. The new company will be known as the RENFREW AIRCRAFT & ENGINEERING CO., LTD.

MASKIN A/B THULE, Malmo, Sweden, will manufacture the Colonial line of the Colonial Broach Co., Detroit, Mich., to serve the European market. The Swedish firm will market the broaching machines and broach sharpeners under the trade name of "Colonial-Thule."

Coming Events

MAY 31-JUNE 3—THIRD BASIC MATERIALS EXPOSITION to be held at Convention Hall, Philadelphia, Pa. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

JUNE 5-8—Annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Homestead, Hot Springs, Va.

JUNE 7-10—National spring meeting of the AMERICAN WELDING SOCIETY to be held at the Hotel Muehlebach, Kansas City, Mo. The Welding Show will be held at the Kansas City Auditorium. Further details can be obtained by writing to the Society, 33 W. 39th St., New York 18, N. Y.

JUNE 8-10—Third Annual Welding Show under the sponsorship of the AMERICAN WELDING SOCIETY to be held at the Municipal Auditorium, Kansas City, Mo. National secretary Joseph G. Magrath, 33 W. 39th St., New York 18, N. Y.

SEPTEMBER 6-17—Machine Tool Show sponsored by the NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION to be held at the International Amphitheatre, Chicago, Ill. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

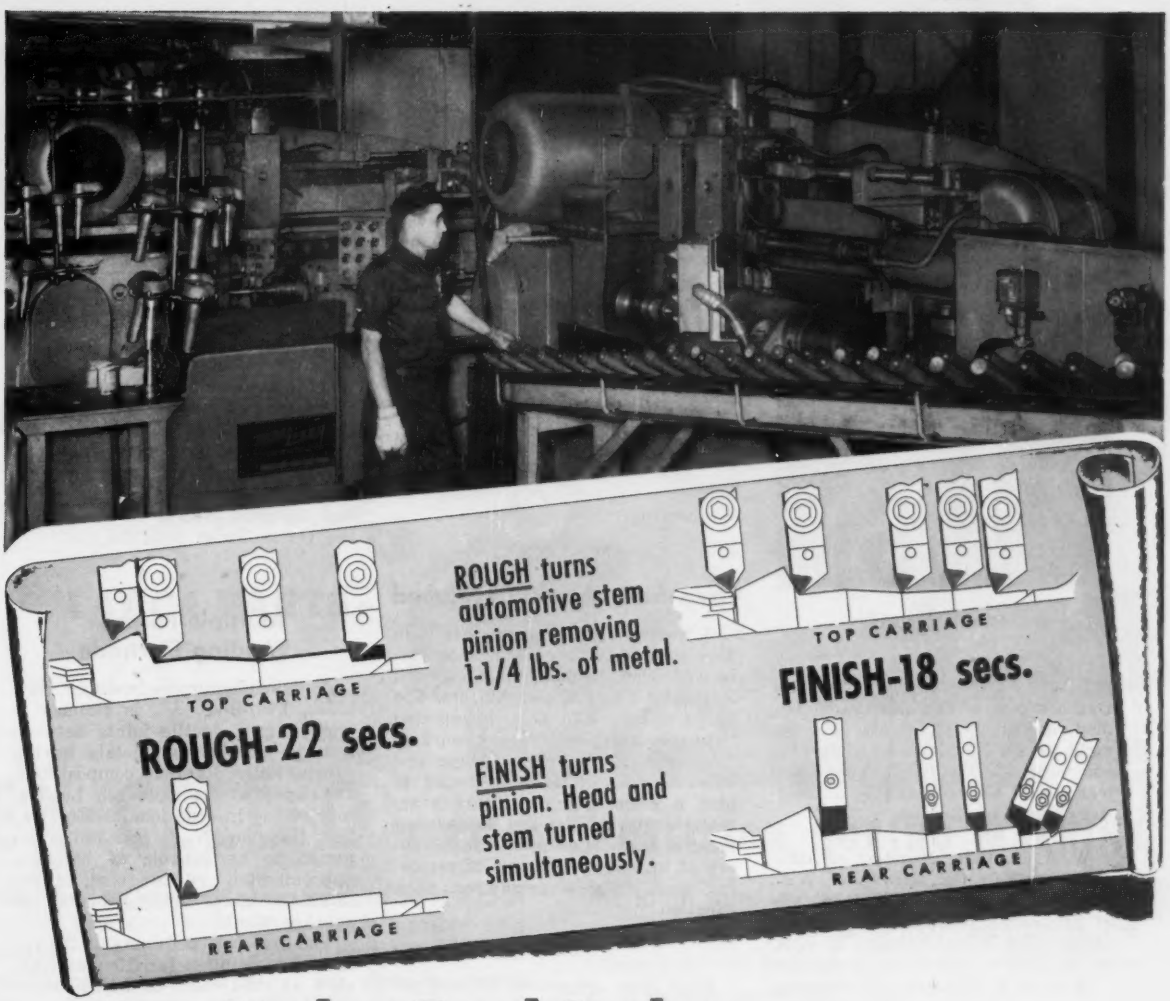
SEPTEMBER 6-17—PRODUCTION ENGINEERING SHOW, coinciding with the Machine Tool Show, to be held at the Navy Pier, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17—METALWORKING MACHINERY AND EQUIPMENT EXPOSITION to be held at the Coliseum, Chicago, Ill. Further information can be obtained from Chester L. Wells, general manager, 2689 East Overlook Road, Cleveland 6, Ohio.

OCTOBER 17-21—National Metal Exposition and Congress sponsored by the AMERICAN SOCIETY FOR METALS at the Convention Halls, Philadelphia, Pa. Further information from American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 23-26 — Semi-annual meeting, AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Edgewater Beach Hotel, Chicago, Ill.

NOVEMBER 14-18—Chicago Exposition of Power and Mechanical Engineering, under the auspices of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, in conjunction with their Seventy-fifth Anniversary Meeting, to be held in the Chicago Coliseum, Chicago, Ill. Further information can be obtained from the International Exposition Co., 480 Lexington Ave., New York 17, N. Y.



New Hydra-Feed Lathes Cut Pinion Machining Costs . . .

Only 2 Hydra-Feed lathes are required to completely R & F turn stem pinions (SAE 4620) at the plant of one of the major automobile producers. Time has been cut, floor space saved, capital investment reduced and chance of errors minimized.

Hydra-Feed lathes are today's answer to these requirements:

Maximum carbide performance (cam or tracer control)
Easy loading or automation (no front obstruction)
Maximum rate of metal removal (short tool travel, too)
Decreased maintenance (J.I.C. throughout)
Smoothness (downward tool pressures and massive design)

Let us tell you . . .

the Hydra-Feed story and how it can cut your costs, improve your quality.

. . . Ask for catalog

HYDRA-FEED MACHINE TOOL CORPORATION

SOUTH NORWALK, CONNECTICUT AND DETROIT (Ferndale), MICHIGAN

Address all inquiries to:

SALES AND ENGINEERING OFFICE, 730 W. EIGHT MILE ROAD, FERNDALE, MICHIGAN

Obituaries

John P. Breuer

JOHN P. BREUER, hob engineer for Barber-Colman Co., Rockford, Ill., died on April 20 at the age of sixty-eight years. He had worked for the company for forty-four years and was one of the outstanding authorities on gear production.

W. A. ROBERTS, president of Allis-Chalmers Mfg. Co., Milwaukee, Wis., died suddenly on April 12 at the age of fifty-seven years. He started his career with Allis-Chalmers in 1924.

WALTER P. KIMMEL, district sales manager of the Oilgear Co., Milwaukee, Wis., died recently at the age of fifty-three years. He was with the company for twenty-eight years.

FRANK A. HITER, senior vice-president of the Stewart-Warner Corporation, Chicago, Ill., since 1944 and head of the Alemite and Instrument Division, died recently in Chicago at the age of sixty-three years. Concerned primarily with sales throughout his long career in the lubrication field, which began when he joined Alemite in 1920, he has been credited with being largely responsible for the adoption of pressure lubrication systems by car and truck builders in the early twenties.

F. J. PETERS, vice-president of the National Automatic Tool Co., Inc., Richmond, Ind., died recently. An employee at Natco since 1921, Mr. Peters was appointed chief engineer in 1934; and in 1948, he was appointed vice-president in charge of engineering.

* * *

Powerful Transistor Developed

A thimble-size transistor has been developed in the research laboratories of the Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. The unit's output of 20 watts is expected to enable it to perform such work as operating motors, valves, relays, and other equipment. It is expected to play a major role in future automatic controls. The key to development of the new unit was the discovery of an effective means of removing heat from a germanium-alloy junction.

* * *

More than 300 pounds of steel per day is made into fish hooks. About 3000 of the popular size No. 6 trout hooks can be made from a pound of wire.

Butterfield Division Celebrates Seventy-Fifth Anniversary

Butterfield Division of the Union Twist Drill Co., Rock Island, Quebec, and Derby Line, Vt., is celebrating its seventy-fifth year of operation. Founded in 1880, the plant has expanded from the manufacture of hand-made, wagon-wheel axle cutters to the precision-made reamers, taps, dies, drills, and cutters of today.

The plant is unique in that the buildings are diveded by the international border and a total of 750 men from Canada and the United States is employed. Each side operates independently of the other. However, they both come under the management of Stanley L. Holland, son of the president, George F. Holland, of the Union Twist Drill Co.

* * *

Multiple-Purpose Welding Electrode

A multiple-purpose welding electrode, Inco-Rod "A", is claimed to yield strong, ductile joints between a large number of metals having substantially different compositions. Developed at the Research Laboratory of the International Nickel Co., Inc., Bayonne, N. J., this rod is expected to be capable of handling approximately 90 per cent of the dissimilar-metal welding jobs in the average plant.

The greatest usefulness of the rod is in the joining of ferritic materials, such as mild steel, to austenitic, or stainless-steel compositions. In addition, either of these steel groups can be successfully joined to high-nickel alloys.

Frank O. Hoagland (center) is shown being awarded the Seventy-fifth Anniversary Medal of the American Society of Mechanical Engineers. This award was presented in recognition of his many years of valued service in contributing toward the advancement of the engineering profession. Mr. Hoagland, master mechanic at Pratt & Whitney, Division Niles-Bement-Pond Co., has been very active in the A. S. M. E. since joining the organization in 1912. Presentation of the Medal to Mr. Hoagland was made by Nicholas Welch (right), director of Research and Development Engineering, American Hardware Corporation, New Britain, Conn., with A. H. d'Arcambal (left), president of Pratt & Whitney assisting.

Versatile, Automatic

BORING, TURNING, FACING OF LARGE PARTS - WITH THIS

Ex-Cell-O Style 425-A Vertical Precision Boring Machine

EX-CELL-O VERTICAL PRECISION BORING MACHINE

Developed by Ex-Cell-O, this standard Style 425-A Vertical Precision Boring Machine is massive and versatile. It has a heavy-duty, high-speed work spindle and rigid tool slides for close-tolerance work with a fine surface finish. It's designed for accurate production work on large parts.

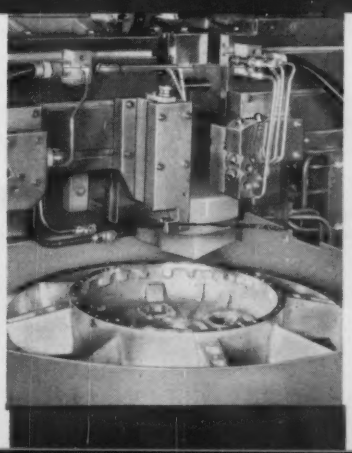
The heavy cast base supports a column on which two vertical slides are mounted, each carrying a cross slide. Slides are operated by large hydraulic cylinders and move on hardened and ground steel ways. Vertical slides are fully counterweighted. All these features mean smoother operation.

The large work spindle supports a 36-inch diameter table having T-slots for mounting fixtures. The table is driven through a precision worm at variable speeds up to 500 rpm.

The machining cycle is completely automatic, including movements of vertical and cross slides, changes in work speeds, flow of coolant, and lubrication.

For more information and complete specifications on this 425-A machine call in your Ex-Cell-O representative or contact Ex-Cell-O in Detroit today.

12 Features OF EX-CELL-O'S 425-A MACHINE:



Close-up view of a Style 425-A equipped for operations on a jet compressor frame. Tools in the left slide face 2 surfaces, turn one diameter and chamfer one edge. The right-hand slide carries tools for feed-facing, precision boring and chamfering.

55-B

- Massive, Rigid Construction
- Easy Loading and Unloading
- Variable Speeds to 500 RPM
- Counterweighted Slides
- Large Hydraulic Cylinders
- Hardened and Ground Ways
- Flexible Automatic Cycles
- Automatic Speed Changes
- Automatic Coolant Control
- Automatic Lubrication
- Conforms to J.I.C. Standards
- Skilled Operator Unnecessary

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Bullard Observes Three-Quarter Century Mark

The Bullard Co. is currently celebrating its Seventy-Fifth Anniversary. From the 30- by 60-foot room in which the first lathes of Edward Payson Bullard were produced in 1880, the company has grown to a sprawling plant covering more than 814,000 square feet in Bridgeport and Fairfield, Conn. Soon, a foundry now being built will raise total floor space to over 1,000,000 square feet.

In introducing his vertical boring mill, the founder made his most important contribution to basic machine design. His idea emanated from the simple observation that it was easier to lay a piece of work down than it was to hang it up. Industry promptly acknowledged the soundness of the principle by flooding the company with orders.

By 1890, Bullard had established a line of lathes, boring and turning mills, box tools, dies and dieholders, pointing tools, and stop gages. Edward Payson Bullard, Jr. joined the company in 1892, and a few years later developed a single-head vertical mill which carried a turret instead of the conventional ram. Later, he added a side-head to increase flexibility and output.

With the advent of mass production in the then infant automotive industry, Mr. Bullard, Jr. foresaw the need for a machine that would incorporate several individual functions. The Mult-Au-Matic, which did just that, was brought out in 1914.

Under the stewardship of Edward C. Bullard, grandson of the founder and now president, the company announced the Man-Au-Trol in 1947. This machine is a vertical turret lathe that cycles automatically. A spacer table—an automatic positioner that eliminates the use of jigs for drilling, reaming, and tapping—also was unveiled at that time. In 1949, the company absorbed the line of horizontal boring, milling, and drilling machines of the Universal Boring Machine Co., and started building them in Bridgeport.

As a fitting tribute to its Seventy-Fifth Anniversary, the company at the turn of 1955 brought out its completely new Cut Master vertical turret lathes, Model 75; Man-Au-Trol vertical turret lathes, Model 75; horizontal boring, milling, and drilling machines, Model 75; and Mult-Au-Matics, Model 75.

Rail Bonds Now Brazed

Rail bonds, the bronze cables which link track sections as electrical conductors, now are secured by a brazing process called "Tigerbraze." This process is a joint development of the American Steel & Wire Division of the United States Steel Corporation; the Nelson Steel Welding Division of Gregory Industries, Inc., Lorain, Ohio; and the Svenska Ab Gasaccumulator, Stockholm, Sweden. The new method enables a track crew to install twice the number of rail bonds in the same time required by former methods.

A gun developed by Nelson delivers a controlled electric arc which generates sufficient heat to form the braze in one second. It avoids high and prolonged temperatures which cause brittleness.

Each bond consists of 5-inch bronze cable with copper lugs on each end. In brazing the bond to the track section, a special knock-off pin and arc-shielding ceramic ferrule are used. The pin has a silver solder portion with a small cavity containing the brazing flux, and a steel portion to which the silver solder cap is applied. A notch on the pin permits it to be knocked off after the lug is brazed.

Members of the Machine Tool Show Committee of the National Machine Tool Builders' Association as they appeared with M. A. Hollengreen, Landis Tool Co., and president of the Association, at a dramatic announcement of the Show during the recent Spring Meeting: (Front row from left to right) W. E. Rutz, Giddings & Lewis Machine Tool Co.; Mr. Hollengreen; and Frank U. Hayes, Bullard Co. (Back row) James C. Hebert, Jones & Lamson Machine Co.; Donald H. McIver, Ex-Cell-O Corporation; Frank Moran, Carlton Machine Tool Co.; Stanley A. Brandenburg, Monarch Machine Tool Co.; and Burnell A. Gustafson, Sundstrand Machine Tool Co. E. P. Cunningham, Clearing Machine Co., and Tell Berna, general manager, National Machine Tool Builders' Association, were absent at the time the photograph was taken.

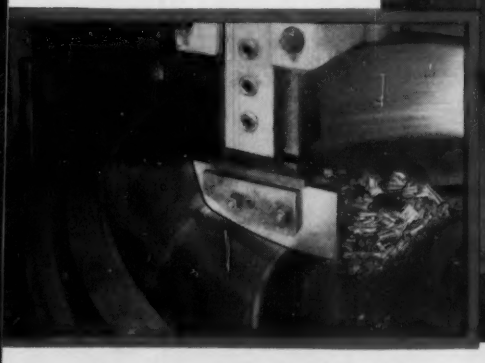
New KING VERTICAL BORING & TURNING MACHINE

at THE AKRON STANDARD MOLD COMPANY

Machines "KING SIZE" Tire Molds

25% Faster!

At right — "Akron's" 120" KING machining huge tire mold. *Below*—Close-up view showing forming cut being taken in the mold, amply demonstrating KING "heavyweight" power and rigidity.



The Akron Standard Mold Company of Akron, Ohio, a KING® Vertical Boring & Turning Machine customer of long standing, recently purchased the 120" KING shown above for manufacturing giant-size tire molds. The mold being machined is size 30.00 x 33, the largest size mold this company has made to date—so large, in fact, that the forming tool had to be made in three separate pieces in order to complete the contour.

Mr. W. P. Voth, President of The Akron Standard Mold Company, reports this new KING "amply fulfills our requirements . . . and turns out work even faster than we anticipated." Mr. Voth estimates that this new KING has increased production on large size molds by 25%.

Here is more on-the-job evidence of typical KING performance . . . the kind of evidence that explains why KING today, as in the past, is industry's logical first choice for fast, accurate, profitable production. KING Machines are made in 10 sizes, 30" to 144", in a wide variety of head combinations. See your KING Distributor, or write to us direct, for complete specifications and illustrated description of construction features.

Visit us at Machine Tool Show—Chicago, Sept. 6-17—Booth 1121

American Steel Foundries

KING MACHINE TOOL DIVISION

1150 TENNESSEE AVENUE CINCINNATI 29, OHIO

NEW CINCINNATI 16″ SLIDING HEAD DRILL THAT LOOKS AS GOOD AS IT RUNS

Here is in-the-metal-proof that a drill doesn't have to be homely to be good. The new Cincinnati 16″ sliding head drill can turn your shop into a showroom in appearance and performance.

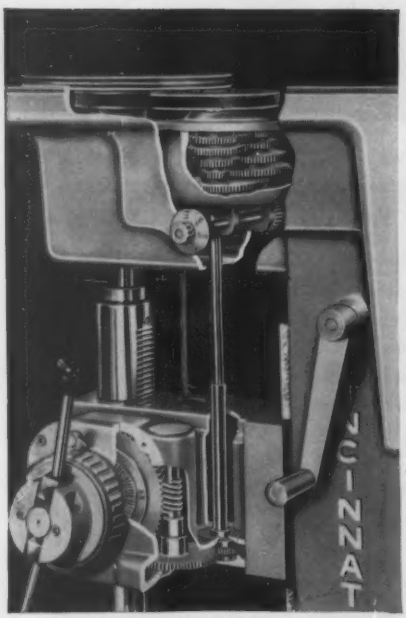
Operators like this new drill because every important element is conveniently located and built in . . . power take-off, gearbox, feed selector, positive jaw clutch, electrical controls, depth dial, counterbalance spring, contour-fitting belt guard.

Best of all, this new drill can be equipped with power feed at slight additional cost . . . bringing the production advantages of automatic operation within the budget of any shop. Every drill is furnished with a pre-shipment test record of accuracy and covered by a one-year warranty. Bench, floor, and multi-spindle models available *now*.

Write for catalog D-138 and name of your local dealer. Cincinnati Lathe and Tool Company, 3268 Disney, Cincinnati 9, Ohio.

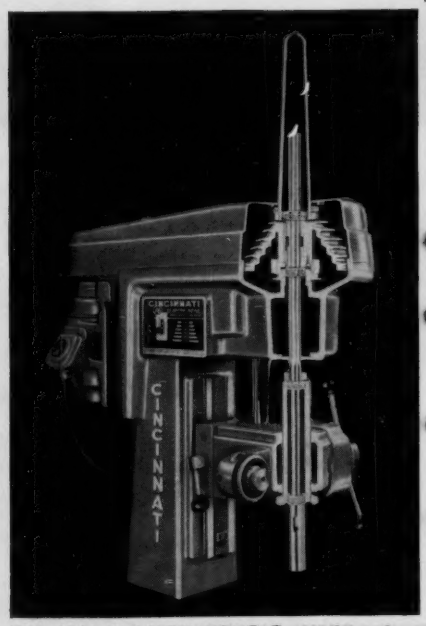
CINCINNATI LATHES and DRILLS

BOOTH NO. 309

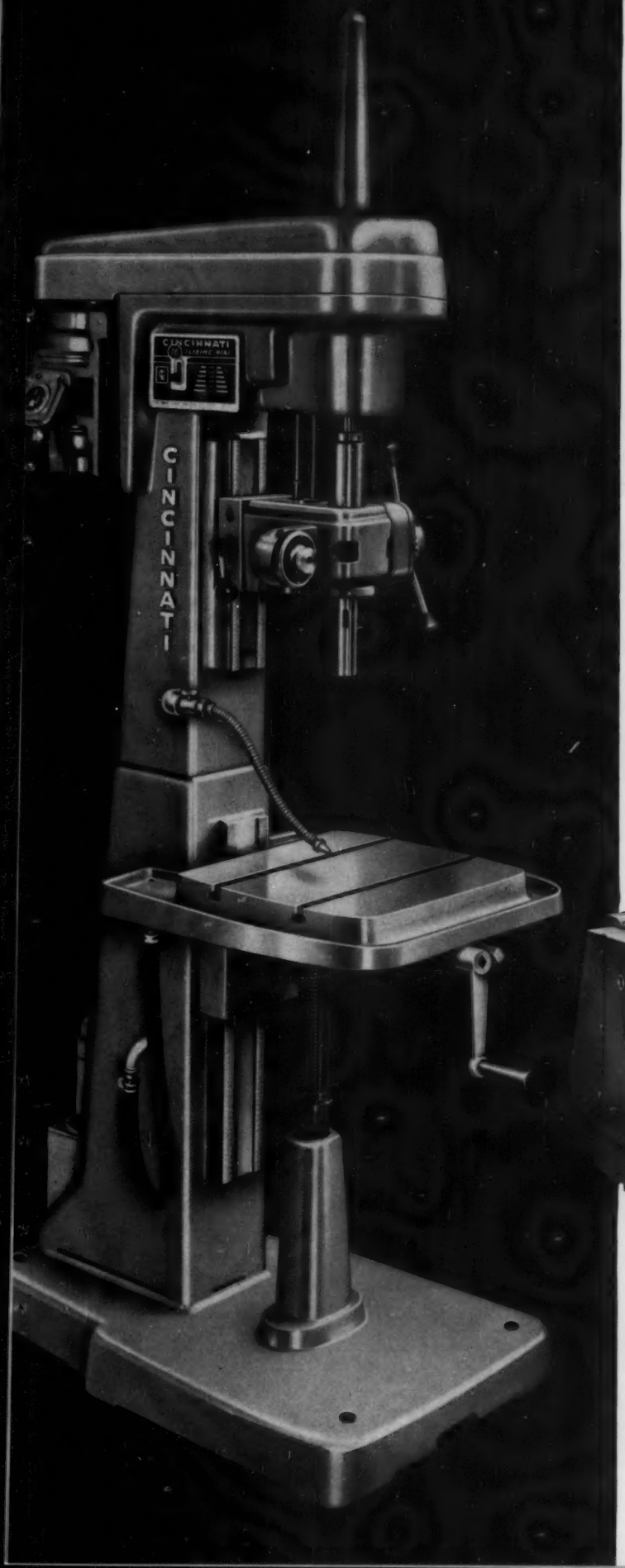


NEW GEARED POWER FEED—Positive jaw clutch engages four power feeds—.002″, .005″, .009″ and .015″ per spindle revolution. Automatic disengage for identical operations. Unit construction.

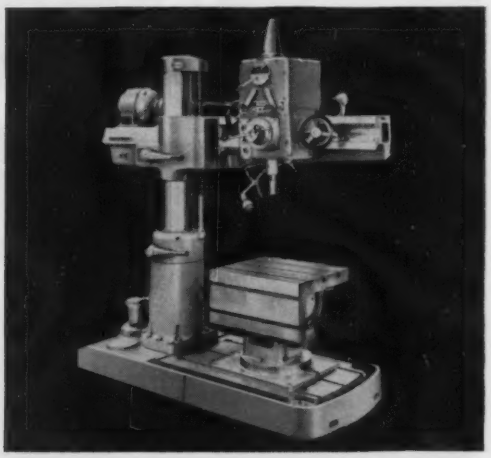
NEW ELECTRICAL CONTROLS—Built right into the head. All drills are shipped *complete* with motors and controls—no installation delays, just connect your power leads, and switch on the motor.



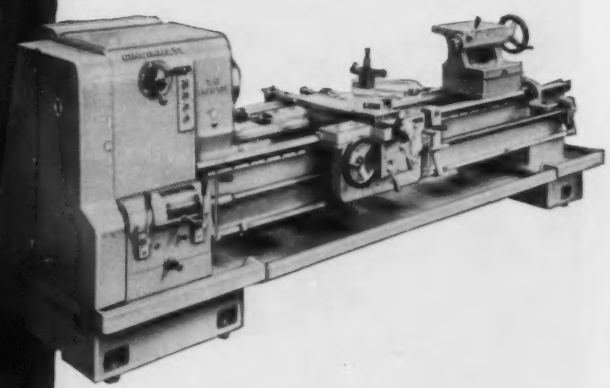
NEW FULL-FLOATING SPINDLE—All this spindle takes is torque! Four precision, sealed, lifetime lubricated bearings (two on spindle and two on pulley) take radial and thrust loads. Six spindle speeds. No. 2 Morse taper is standard; No. 3 Morse taper optional.



SEE THESE OTHER BRAND-NEW CINCINNATI TOOLS



3′ 7½″ Radial Drills with Hard Clad Columns.



10″, 12½″, 15″, 18″, 21½″ and 26″ Tray-Top Engine, Toolroom and Fixed Gap Bed Lathes with Hard Clad Bedways.

c

center on . . .

cincinnati lathes and drills

Eliminates model change-over problems!

a special production machine—with standard units . . . quick change-over features for each year's design change. completely automatic—requires only part loading and unloading.

Morris Unit-Type Machine Tools provide truly specialized machining of your product . . . using standard production components . . . add flexibility to your high-speed mass production operations. They may also be re-aligned and additional drill units added for model alterations, or for complete new models, without scrapping the machine.

For example, the Morris MOR-SPEED production machine illustrated, drills, burrs, reams, taps and spotfaces carburetor air horns at the rate of 375 pieces per hour at 80% efficiency!

Its standard basic construction provides a stationary circular center column with Morris AIR-OIL-MATIC Drill Units mounted on the column and on the removable platen for station operations. Parts are placed in air-power clamped fixture by the operator. The table indexes automatically through 12 stations, controlled by hydraulic indexing mechanism. 24 operations on 21 holes on 4 perpendicular faces and one angular face are performed on each piece. Operator merely loads unfinished pieces, unloads completed parts. Cams on center column automatically index and position fixtures at each station.

Morris AIR-OIL-MATIC Drill Units, mounted in vertical, horizontal or angular planes at the stations, provide accurate high-speed machining.

Easy Maintenance

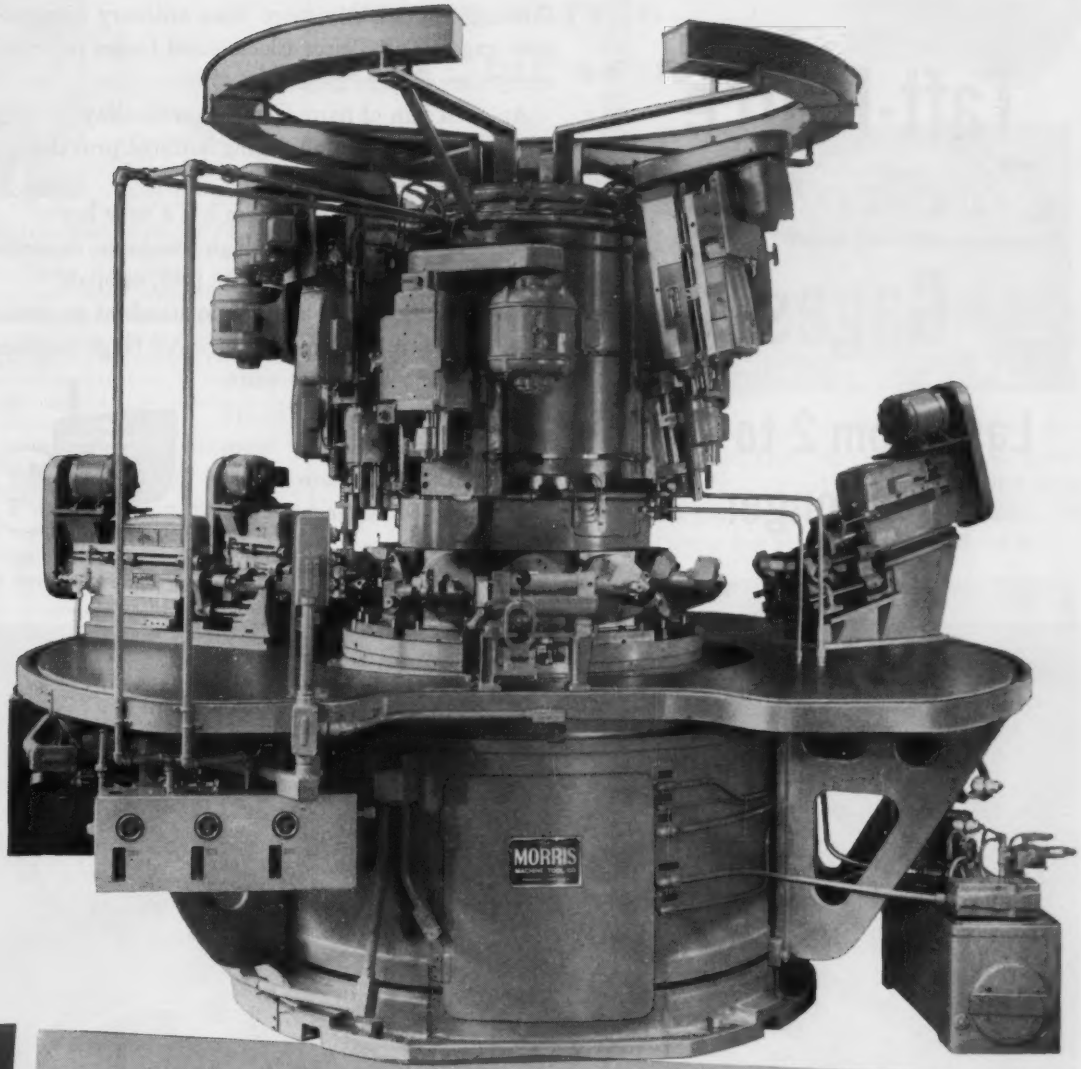
Each drill unit is provided with independent feed and speed, permits adjustment of individual units without affecting entire machine. Standard units, stock parts, speed machine maintenance. Operational difficulties may be pin-pointed, given prompt attention.

MORRIS AIR - OIL - MATIC DRILL UNITS

Adjustable Feed, Stroke and Rapid Approach • Trouble-free Hydraulic System
• Wide Range of Spindle Speeds • Convenient Controls
• Air or Oil Powered • Hydraulically Controlled

A powerful package of precise versatility, developed by Morris, one of the nation's leading manufacturers of high production drilling machinery. Available for use in special purpose machines like the production machine illustrated.

AIR OR OIL POWERED — HYDRAULICALLY CONTROLLED! Designed for a wide range of drilling, reaming, chamfering, spot-facing, hollow milling, centering and related operations, the unit can be mounted in vertical, angular or horizontal positions. The Morris AIR-OIL-MATIC Drill Unit has adjustable feed rate, feed stroke and total stroke. Controls and actuating devices can be set to provide almost any sequence of operations.



You'll want to know how MORRIS Unit Type Machine Tools, MORRIS AIR-OIL-MATIC Drill Units can be applied to solve your mass production involving multiple drilling, reaming, tapping and boring.

Write for detailed descriptive literature . . . or outline your production problem for prompt attention by Morris engineers.

THE MACHINE TOOL SHOW

VISIT US AT BOOTH #912
THE MACHINE TOOL SHOW
Chicago, Illinois, Sept. 6-17, 1955
International Amphitheater

Builders of MOR-SPEED Tools

Morris

THE MORRIS MACHINE TOOL CO.

946 HARRIET STREET . CINCINNATI 3, OHIO

Taft-Peirce *Electrolized* Gages

Last from 2 to 10 times longer

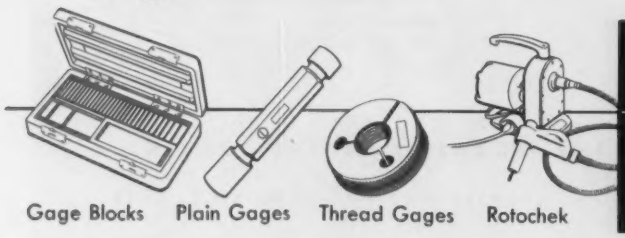
Costing only slightly more than ordinary hardened steel gages, Taft-Peirce Electrolized Gages provide many times longer gage life.

An even film of hard, non-magnetic alloy — only .000025″ thick — on all gaging surfaces provides exceptional wear-resistance.

Extremely smooth, this film has a very low co-efficient of friction, with high resistance to corrosion. Extremely tough, it won't chip, peel, or spall.

Electrolizing can be applied to standard or special fixed gages and to CompAIRator Air Gage members. Accuracy is held to the same high standards found in all Taft-Peirce gages. For more details on the complete line of Taft-Peirce Fixed Gages, write for Handbook.

See them in action at the Show — Booth 811



Gage Blocks Plain Gages Thread Gages Rotochek

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

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Talking About Die Sets

WITH

PHIL MARSILIUS

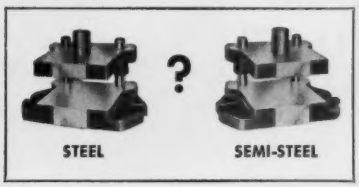
Vice-President
The Producto Machine Co.

Steel vs. Semi-Steel—What should your choice be when selecting a catalog die set? Quite often, the answer is a matter of dollars and cents. Naturally, you'd like to tool-up as inexpensively as possible but you must also be sure that an initial savings will not result in excessive replacement costs later on. In making a choice, the complete cost of tooling-up and maintenance during operation should be considered along the following lines:

Initial cost of either type;
Cost of machining either type;
Unit cost of die set per part produced;
Replacement cost in event of damage.

Taking each point individually, if two dies are identically made, except that one is mounted in a semi-steel die set and the other in a steel set:

The semi-steel set will cost less, machine easier, and have a lower cost per unit produced, if not replaced due to damage;



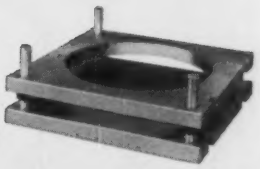
The steel set will cost more and require more machining time but may reduce the probability of breakage if excessive machining is performed on the die bed, and thus reduce the unit cost per part produced.

In general, for the average stamping operation, with all points considered, a semi-steel set is probably more economical. For heavy stamping operations, or for those that will run for a long time, a steel set would be the more practical. Either type can be purchased in the two grades of accuracy—Master-Precision and Commercial.

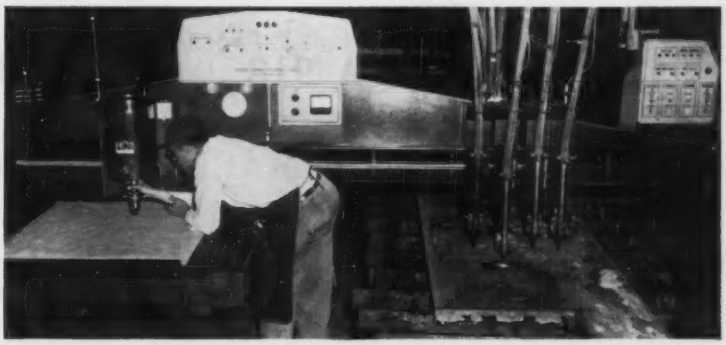
Where the advantages of a steel die set are desired and the savings of a semi-steel set are important, a combination of semi-steel punch holder and steel die holder offers an obvious, though seldom considered, solution.

Special Die Sets—When special die sets will have irregular contours, steps, bosses and other built-up sections or machined pockets, a set with these components integrally cast offers extensive savings in machining or fabricating costs.

WHERE BETTER
STEEL DIE SETS START



Catalog Sets Begin as mill-cut steel punch holders and die beds, shown above in a partial view of the Producto stockpile. These steel blanks are readily available to replace inventories of completely machined components, permit immediate completion of large orders for any one size. Pre-cutting of catalog components leaves flame-cutting equipment free at all times for work on specials.



Special Sets Begin their journey through the Producto plant at modern flame-cutting machines like the one shown above. Always open for specials only, this machine cuts any shape of plate up to 8" thick. Operator is tracing template, contours of which are reproducing a 3" thick punch holder for a special set. Latest-type equipment manned by skilled operator gives greater accuracy of dimensions for length and width of sets and cut-out or drop-out holes, by permitting straighter, cleaner flame-cut edges.

From stockpile to shipping room, Producto's unmatched modern facilities are keyed to meet your every die set need quickly. For precision die sets fast, call your nearest Producto branch.

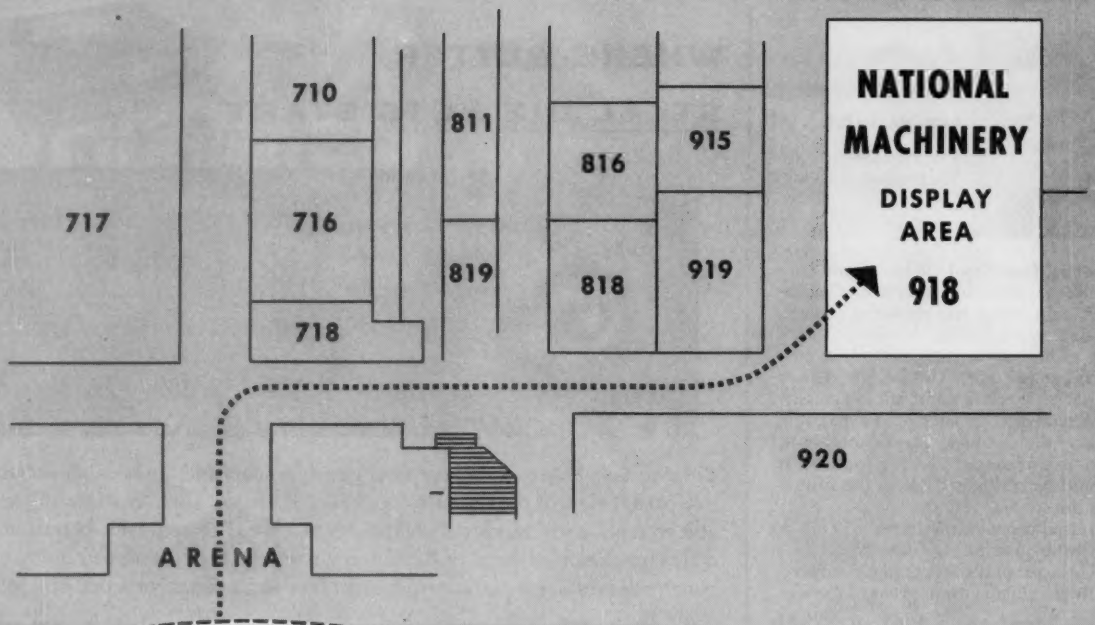
THE PRODUCTO MACHINE COMPANY
985 Housatonic Avenue, Bridgeport 1, Connecticut
FOrest 7-8675

For prompt die set service, 'phone these PRODUCTO assembly warehouses:

Atlanta	CY 7667	Detroit	LI 6-7600	New York	WO 4-7484
Chicago	ES 8-3307	Kansas City	VI 1162	Philadelphia	MO 4-1010
Cleveland	SU 1-6158	Los Angeles	TR 9826	Rochester	GL 1810
Dayton	MU 1651				

or check the Yellow Pages in any stamping center in the United States or Canada for distributors stocking PRODUCTO.

Produce More With PRODUCTO ***Die Sets***



DISPLAY AREA 918 . . . PROGRESS IN FORGING

AT THE MACHINE TOOL SHOW,

CHICAGO, SEPTEMBER 6 TO 17!

We at National Machinery, WHQ*
for the development of advanced methods
and machinery for the forging industry,
for more economically producing
a wide variety of parts—
routine or unusual, ferrous or non-ferrous,
automatic or semi-automatic,
by cold forging or hot forging—
invite you to visit our working exhibit
at the coming machine tool show,
the first in seven years!

* WORLD HEADQUARTERS

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO—SINCE 1874

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

Hartford Detroit Chicago

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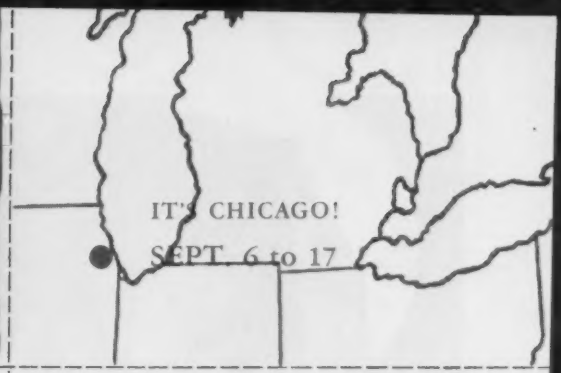
New



Series 90 Dyna-Shift

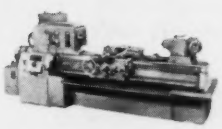
Metal-working

Don't miss the NMTBA's Machine Tool Show in Chicago—September 6 to 17 and don't, for better business' sake, miss our Monarch display there!

Object of the show, of course, is to demonstrate what the industry's best engineering brains have developed in the way of machines that lower costs by improving both output and accuracy.

Techniques—for

We'll be there, for instance, with a great many new lathe improvements, including two freshly announced this year. Those would be our new Series 90 Dyna-Shift Heavy Duty Lathe, plus the new Series 62 Preselector Dyna-Shift. So productive and so absolutely different as to defy comparison, they are two of many reasons why you cannot afford to miss *the world's best investment—in action.*



Series 62 Preselector Dyna-Shift

Business

We'll have more, too. And looking them over will be good for business—yours and ours, both. See you at the show! . . . . . THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO.

Advance-ment

Monarch

ACCURACY • ECONOMY • LONG LIFE

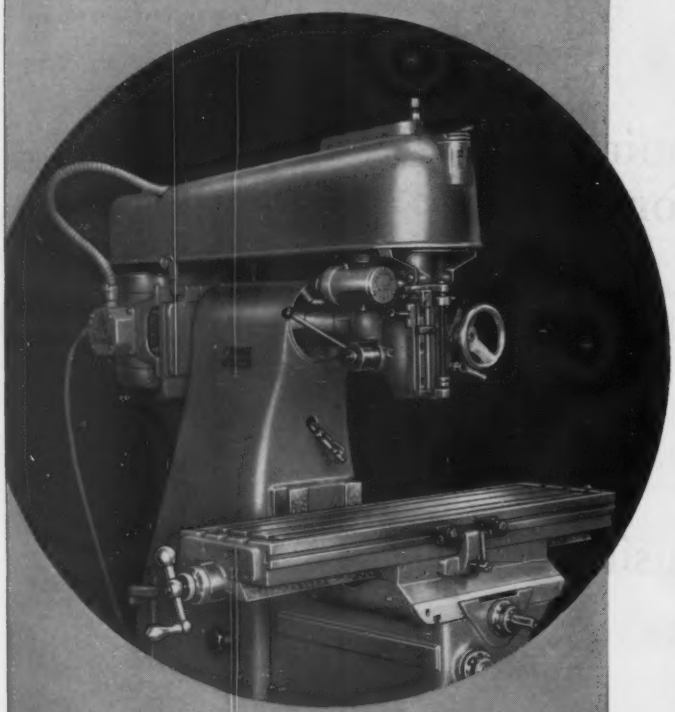
TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

does MORE work... MORE easily

new POWER FEED HEAD

U. S. Vertical Miller



Write for descriptive folder

Here's the new U. S. Vertical Miller with Power Feed Head – the head into which U. S. has built all the most wanted features without sacrificing traditional U. S. simplicity. Check its infinitely variable feed rate, its 800 pounds of down thrust on the quill, its supplemental hand feeds – it is the milling head that was designed to meet all shop needs.

Add to these the basic advantages of the U. S. Vertical Miller. You can easily see why it's the milling machine that "does more work more easily."

Detailed literature on request.
The U. S. Burke Machine Tool Division.
17 Brotherton Road, Cincinnati 27, Ohio.

more versatile
Feed infinitely variable from .002" to .008" while in operation

greater capacity
5½" power quill travel; 800 lb. down thrust

more convenient
Supplemental hand feeds

increased rigidity
Enclosed hard chrome plated quill with internal lock

THE U★S★Burke MACHINE TOOL DIVISION

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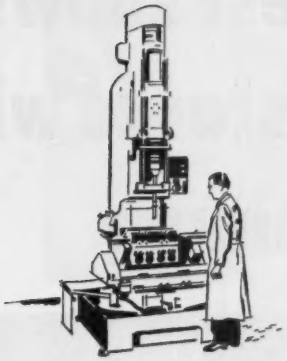


"Today... Rejection rate is NIL!"

A large Midwest pump manufacturing company had run up against an expensive finishing problem. They were using a super finisher with an abrasive stone to cut and polish 410 stainless steel shafting to a four micro finish. The hardness of the shafting was Rockwell B60-90. Although they tried a number of honing fluids recommended by various companies, the rejection of finished shafting was high and stone life was short. On a routine call, Sinclair Industrial Representative P. W. Stevens was asked for his recommendations.

Light-bodied coolant recommended...

Mr. Stevens reports, "Examination showed the need for a light-bodied coolant specifically designed for use as a honing fluid for both ferrous and some non-ferrous metals. From previous experience with a similar problem, I recommended Sinclair HONOL Medium."

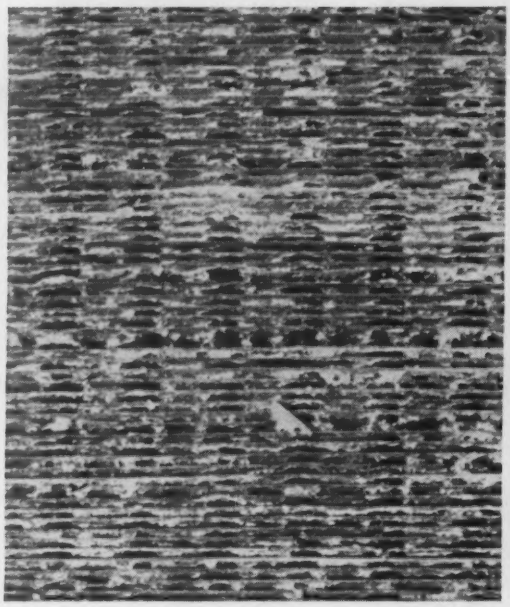
Problem solved...

Mr. Stevens continues, "The company tried Sinclair HONOL Medium on a test basis. A follow-up showed they were getting exceedingly fine finish and accuracy, with sufficient carry-off of steel particles during the honing operation. The amount of heat generated was kept to a minimum, thus preventing distortion of parts. The company reports that today their rejection rate is nil. Moreover, all pieces have the desired four micro finish, and stone life has increased considerably. This manufacturer now specifies Sinclair HONOL Medium for his finishing operations, and uses the same product for honing brass."

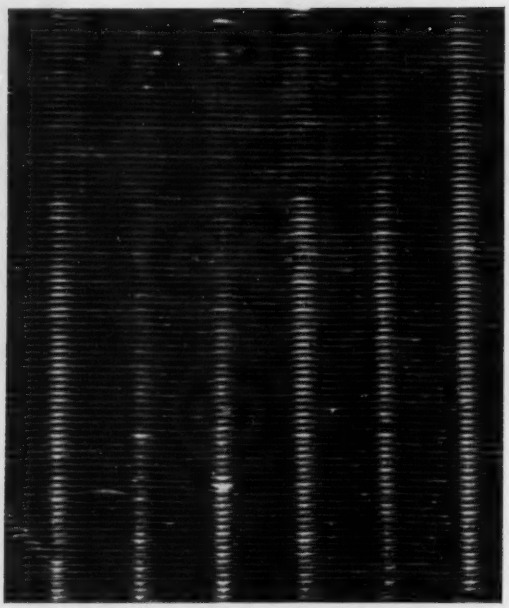
Why not let a Sinclair Lubrication Engineer help solve *your* lubrication problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N.Y.

SINCLAIR LUBRICANTS

1150-hour salt spray test shows increased corrosion resistance with Bonderite on aluminum



UNTREATED. *Unretouched photo of section of aluminum refrigeration air conditioner condenser after 1150 hours in salt spray. Note corrosion.*



BONDERITE-TREATED. *Unretouched photo of identical aluminum refrigeration air conditioner condenser after 1150 hours in salt spray. Note absence of corrosion.*

If you want more effective bare corrosion resistance or increased durability for paint, treat aluminum and its alloys with Bonderite.

Special formula Bonderites have been developed and tested and proven thoroughly for this purpose. They form a thin, irridescent, remarkably effective integral coating with the aluminum in simple and economical operation. Solutions are sludgeless, easily controlled, and produce results of uniform high quality.

The Bonderite coating is flexible, withstanding moderate draws without trouble. The coating conducts electricity, necessitating no change in arc and spot welding procedures. Bimetallic and galvanic corrosion resistance is high.

Bonderite for aluminum is shipped in concencentrated liquid form, easy and safe to handle and use.

Get complete information on this more effective protection for aluminum and its alloys. Write for bulletin on Bonderite 710 and 720.

**Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.*

Since 1915—Leader in the Field

PROTECTED BY Bonderite PARKER RUST PROOF CO. QUALITY CORROSION RESISTANT

PARKER RUST PROOF COMPANY

2194 E. Milwaukee, Detroit 11, Michigan

BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

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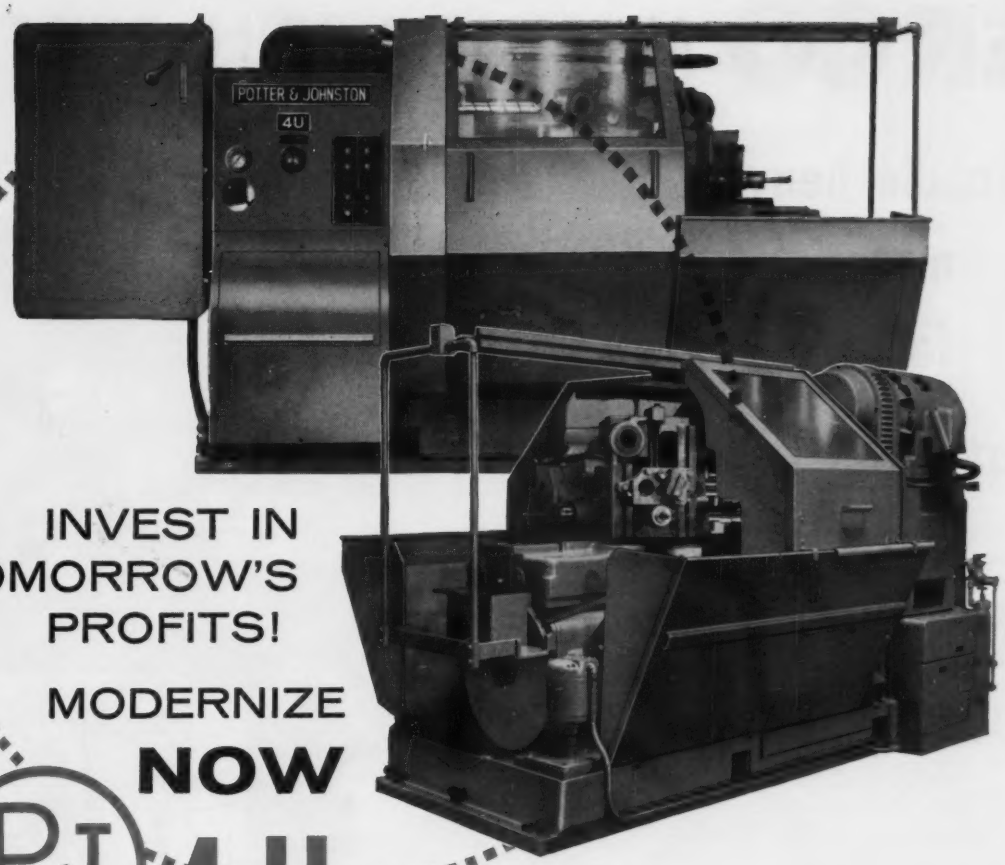


INVEST IN TOMORROW'S PROFITS!

MODERNIZE NOW

THE P&J 4-U AUTOMATIC TURRET LATHE

The Potter & Johnston 4-U Automatic Turret Lathe is designed and built SPECIFICALLY to handle today's tough alloys faster and more economically.

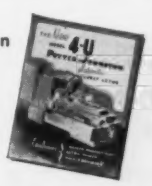
Check THESE 4-U PRODUCTION FEATURES

- **EXTRA SPEED and POWER** . . . 25 hp motor with all-clutch drive and spindle speeds to 1177 rpm takes full advantage of faster-cutting carbide tooling. On a recent job, a P&J 4-U consistently removed ***4 pounds of metal in just 30 seconds!***
- **GREATER RIGIDITY** . . . to maintain high precision and eliminate tool chatter under the heaviest cutting conditions.
- **UNUSUAL VERSATILITY** . . . independent front and rear cross slides, overhead pilot for added tool capacity, and many other features . . . plus expertly engineered P&J Tooling . . . means greater profits for a wide variety of work types and sizes.
- **FAST, SIMPLE SET-UP** . . . because ***all*** machine functions are controlled from a conveniently located, extra large dog drum.

POTTER & JOHNSTON CO.
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY

LET P&J SHOW YOU THE WAY

Send now for complete information on the 4-U and other P&J Automatics



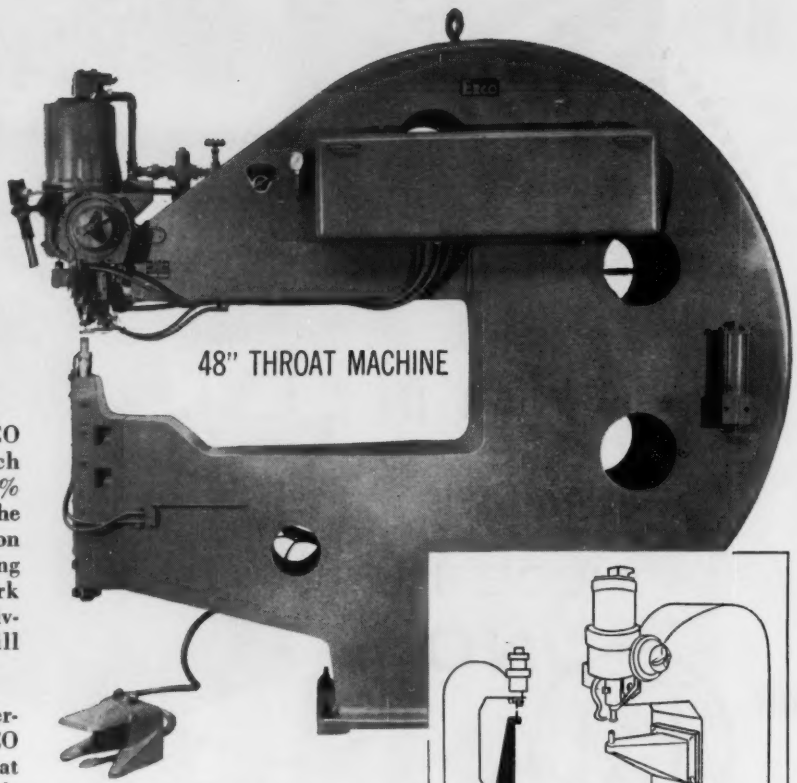
SEE US AT BOOTH 1219

PRECISION PRODUCTION TOOLING P&J FOR MORE THAN FIFTY YEARS

ERCO AUTOMATIC DRILL RIVETERS

handle heavier materials faster...

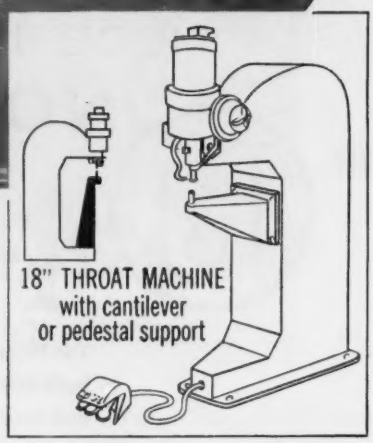
at lower cost!



Like the well known ERCO Automatic Punch Riveters which boost production as much as 400% and cut labor costs up to 80%, the *Drill Riveters* offer great savings on riveting jobs that are beyond punching range thickness. Air gapped work combinations unsuited to punch riveting are easily handled by drill riveting.

Because they combine four operations in one continuous cycle, ERCO Automatic Drill Riveters perform at rates far surpassing other methods now in use. These operations are:

1. Drilling up to ¼" diameter holes in ½" maximum combined material thickness.
2. Drill countersinking for flush riveting.
3. Automatically feeding rivet.
4. Heading rivet.



VERSATILITY . . . another plus!

Flush riveting solid rivet in solid work

Plain riveting solid rivet in solid work

Plain riveting tubular rivet in work with air gap

These machines can handle all types of solid or tubular rivets from 3/32" to 1/4" diameter, for drill riveting in aluminum, copper, brass, steel, plastic, fiber and wood. If you have a special fastening problem, ERCO's experienced staff will analyze it and adapt a machine to it.

For complete information, write:

ENGINEERING and RESEARCH

A DIVISION OF acf INDUSTRIES INCORPORATED

RIVERDALE, MARYLAND

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GEARS *that keep* AMERICA *on the* GO!

Gears turn horsepower into motion—whether for work or for pleasure. In vehicles of almost every description—from boats to heavy farm machinery—you'll find flywheel ring gears, transmission gears, differential drive gears, and other gears that are designed, engineered, and manufactured by Automotive Gear Works rendering the best possible service in the transmission of power.

If you have a product that serves up-and-going America it may be worth your while to learn how our staff and facilities can best be utilized to supply all your gear needs—and how we serve as the "gear department" for many leading manufacturers. Why not write today for further information?

DOUBLE DIAMOND TRADE MARK GEARS

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Automotive Gear Works, inc.

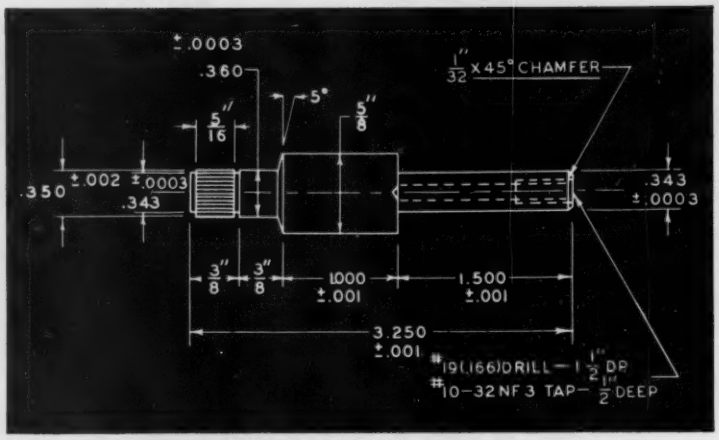
ESTABLISHED IN 1914 RICHMOND, INDIANA

Will Your Single Spindle Automatic Screw Machine Make This Part In 28 Seconds?

Tests show it normally takes your machine 3 times as long with less precision.

At demonstrations all over the country thousands of screw machine men have watched intently as the Detroit Screwmatic 750 box tool turned; spotted; deep-hole drilled; tapped, rough and finish formed; knurled; and cut off.

All this in just 28 seconds after the ⅝-inch diameter, leaded free machining steel bar stock was fed to the turret tools. And each time part tolerances were as close as ± .0003.



Dimensions and Tolerances

COMPARISON TESTS WITH 3 LEADING SCREW MACHINES

. . . in three totally independent job shops show: Each of the other three took 90 seconds or more to turn this complicated part. Each required two feed-outs. Each machined the part with tolerances ranging from ± .001 to ± .005.

The Screwmatic formed the part • with three to five times greater precision • with only one set-up • in one-third the turning time • of any one of the other three screw machines.

No wonder all who watch the Screwmatic perform say, "It's the greatest advancement in screw machine engineering in 20 years."

We invite your comparison!

These 6 Features Make This Record Possible

(1) Greater adjustable distance between turret and chuck.

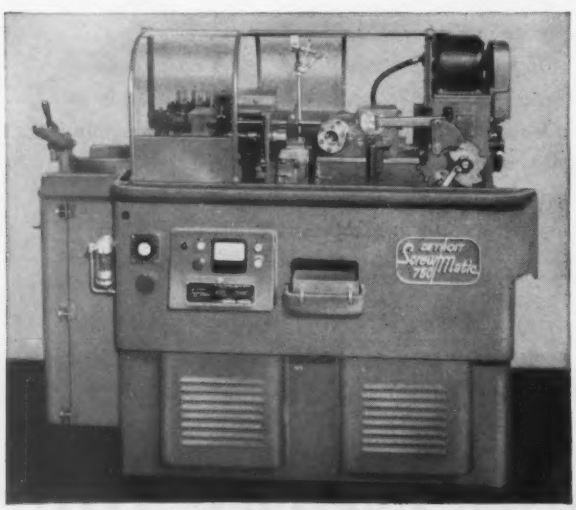
(2) Easily adjustable turret crank permits turning of long, medium, and short work with equal efficiency.

(3) Silent, endless V-belts drive spindle smoothly at high or low speeds with non-slipping power.

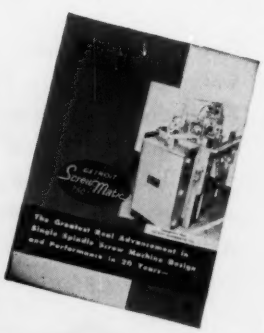
(4) Three infinitely variable pre-selected spindle speeds available for any work cycle. Long cuts at high speeds step down to second speed for accurate forming. Third speed taps and threads. Your present two-speed screw machine is not that flexible.

(5) A three-step V-belt drive makes choice or change of indexing time possible —from 1/4 to 1/3 to 1/2 second.

(6) Vertical slide with rugged, positive action is part of the Screwmatic's standard equipment. Easily adjustable, this third slide forms or cuts off accurately.

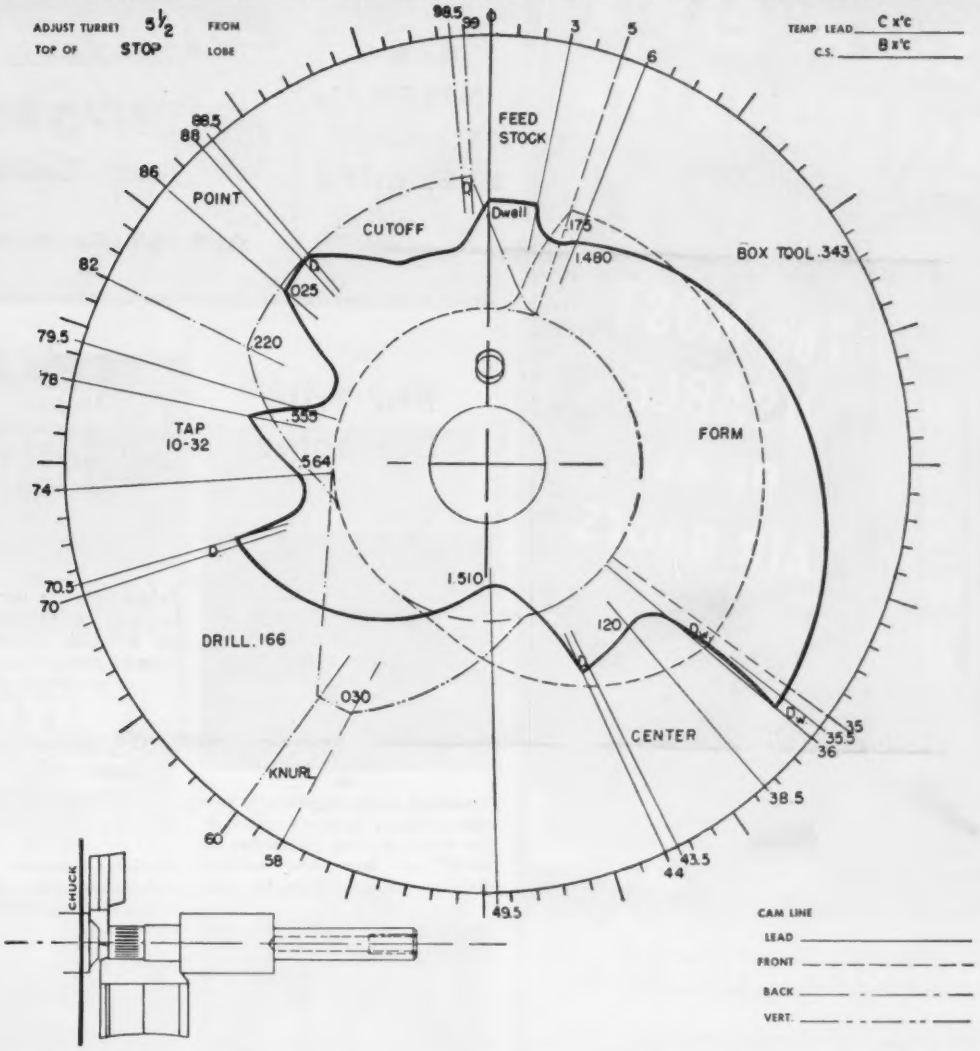


Send for new six-page folder of facts, photos, and specifications. See it yourself at your dealer's. Write for name of dealer nearest you.



BOOTH NO. 315

COMPARE YOUR CAM LAYOUT WITH THE SCREWMATIC'S



OPERATION	THROW	FEED	REV.	REV	100	TOTAL	CD.
FEED STOCK - ORS Rev. Stop	Dwell			15.	3	3	1¼
Index & FORM	.175	.0007	250	15	3	6	
BOX TOOL - ORT Boyar-Schultz	1.480	.006		156	30	36	0
Index				15.	2.5	38.5	
CENTER - 5/16" in ODRH Holder	.120	.003		40	5.5	44	1 5/8
Index & KNURL	.030	.002	15	15.	5.5	49.5	
DRILL - Rev. Deep Hole Drill	1.510	.0034	445	180	21	70.5	1¼
Index & Change Speed to 1000				15.	3.5	74	
TAP IN - 1000 S.S.	.564		18	33	4	78	1 7/16
TAP OUT - 3100 S.S.	.555		18	10	1.5	79.5	
Index & Change Speed to 1800				15.	6.5	86	
POINT - OAP Boyar-Schultz	.025	.0015		17.	2.5	88.5	1⅛
CUTOFF	.220	.0015	150	95	10.5	99	
Clear					1	100	

MARK ON LEAD CAM P. & T. NO.
S.S. 1800-1000 R.P.M. FWD.
3100 R.P.M. BKWD.
GEARS 63-47
SEC. 28 G.P.H. 128 D.S. 180 R.P.M.

MARK ON CROSS SLIDE CAMS P. & T. NO.
FRONT FORM BACK CUTOFF VERT. KNURL

MAT. 5/8 Rd. Ledloy
MACHINE SCREWMATIC-750 SERIAL

DETROIT Screw Matic 750

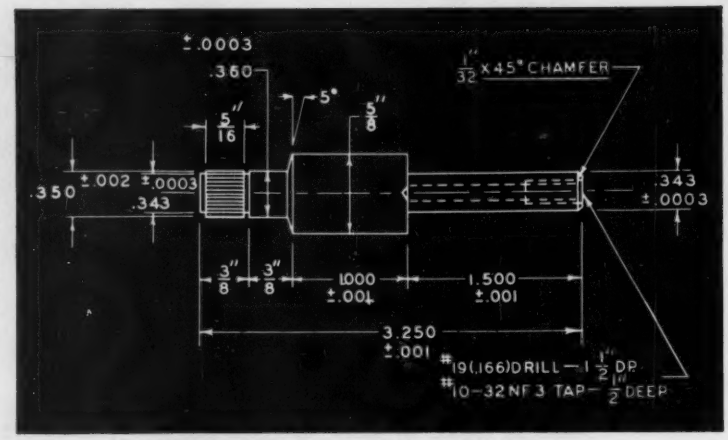
A Product of the
GEAR GRINDING MACHINE CO.
3921 Christopher, Detroit 11, Michigan

Will Your Single Spindle Automatic Screw Machine Make This Part In 28 Seconds?

Tests show it normally takes your machine 3 times as long with less precision.

At demonstrations all over the country thousands of screw machine men have watched intently as the Detroit Screwmatic 750 box tool turned; spotted; deep-hole drilled; tapped, rough and finish formed; knurled; and cut off.

All this in just 28 seconds after the ⅝-inch diameter, leaded free machining steel bar stock was fed to the turret tools. And each time part tolerances were as close as ± .0003.



Dimensions and Tolerances

COMPARISON TESTS WITH 3 LEADING SCREW MACHINES

. . . in three totally independent job shops show: Each of the other three took 90 seconds or more to turn this complicated part. Each required two feed-outs. Each machined the part with tolerances ranging from ± .001 to ± .005.

The Screwmatic formed the part • with three to five times greater precision • with only one set-up • in one-third the turning time • of any one of the other three screw machines.

No wonder all who watch the Screwmatic perform say, "It's the greatest advancement in screw machine engineering in 20 years."

We invite your comparison!

These 6 Features Make This Record Possible

(1) Greater adjustable distance between turret and chuck.

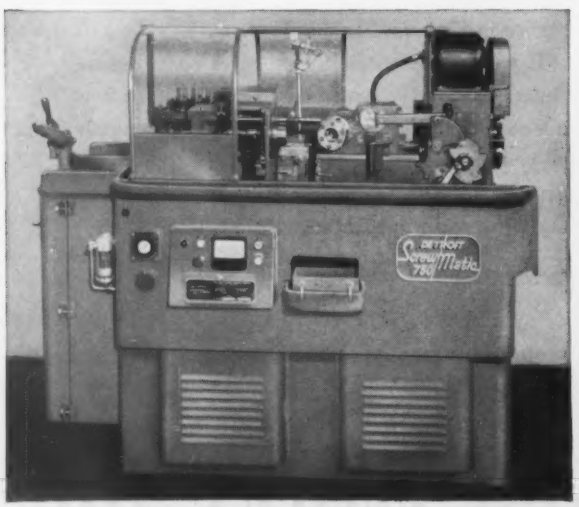
(2) Easily adjustable turret crank permits turning of long, medium, and short work with equal efficiency.

(3) Silent, endless V-belts drive spindle smoothly at high or low speeds with non-slipping power.

(4) Three infinitely variable pre-selected spindle speeds available for any work cycle. Long cuts at high speeds step down to second speed for accurate forming. Third speed taps and threads. Your present two-speed screw machine is not that flexible.

(5) A three-step V-belt drive makes choice or change of indexing time possible —from 1/4 to 1/3 to 1/2 second.

(6) Vertical slide with rugged, positive action is part of the Screwmatic's standard equipment. Easily adjustable, this third slide forms or cuts off accurately.



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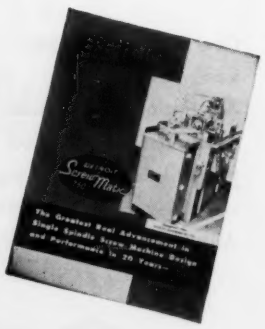
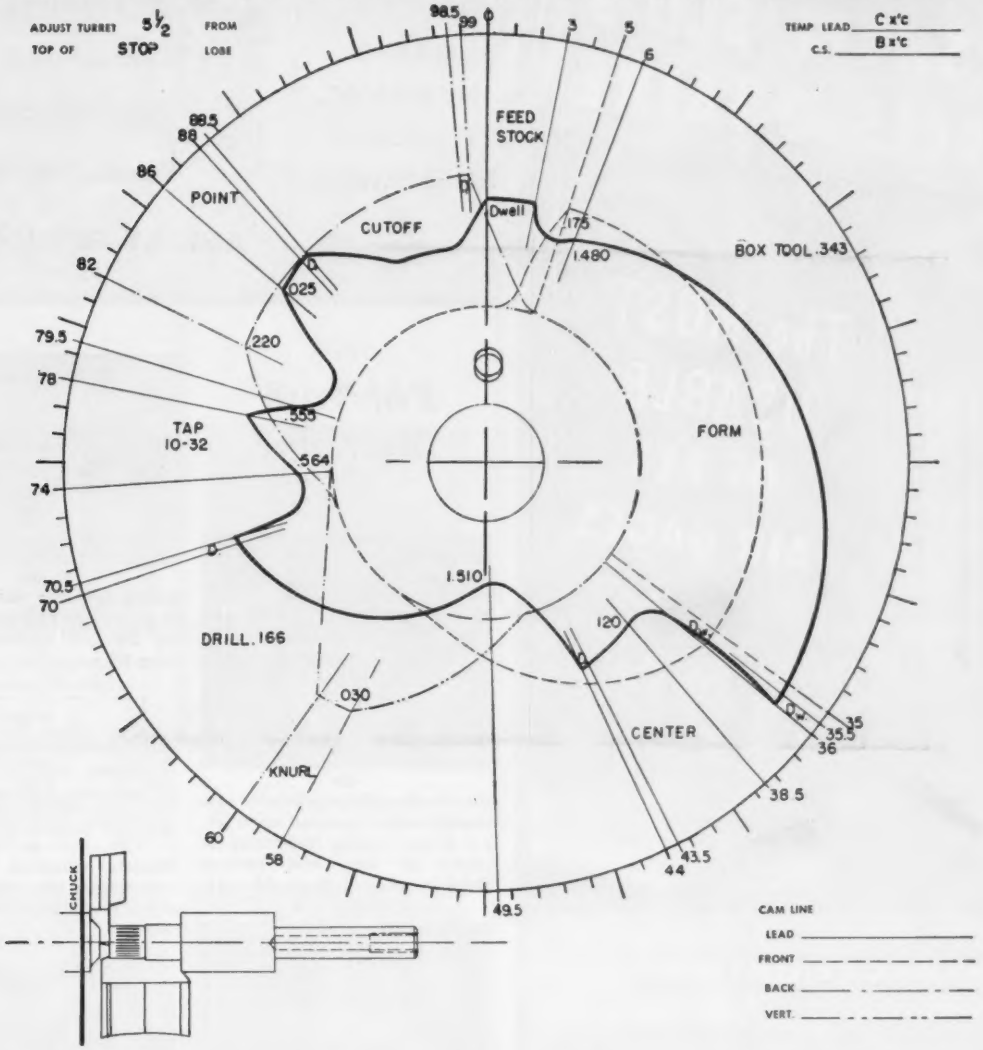


BOOTH NO. 315

COMPARE YOUR CAM LAYOUT WITH THE SCREWMATIC'S



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MARK ON CROSS SLIDE CAMS P. & T. NO.
FRONT FORM BACK CUTOFF VERT. KNURL

MAT. 5/8 Rd. Ledloy
MACHINE SCREWMATIC-750 SERIAL

DETROIT Screw Matic 750

A Product of the
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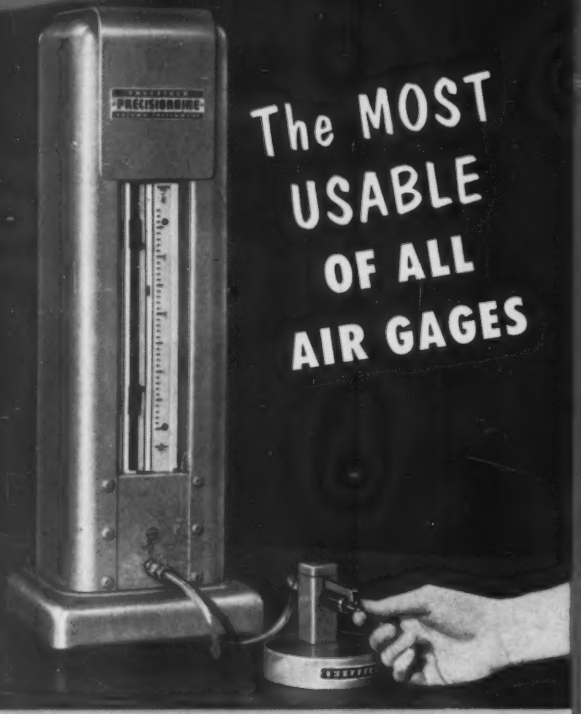
What You Can

WITH SHEFFIELD'S PRECISIONAIRE



The MOST USABLE OF ALL AIR GAGES

CHARACTERISTICS

High precision with instant response

Has widest amplification range — 100 to 100,000-1

Accommodates widest tolerance range — .000005 to .100

Amplifications and tooling interchangeable

Provides quickest change in amplification

Longer scale facilitates classifying parts and provides greater approach range

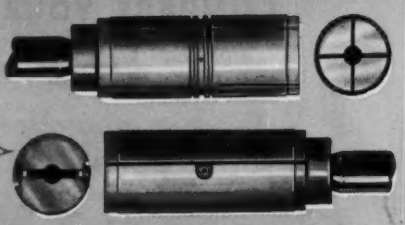
Easier to read — no need to squat and squint

Human error minimized

Checks one dimension or many simultaneously

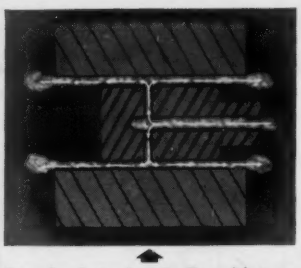
Elements have long service life

BASIC INTERNAL TOOLING ELEMENTS

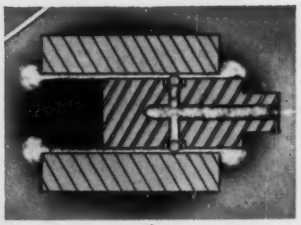


AIRJET SPINDLE

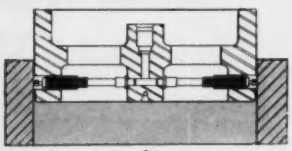
For True Diameter



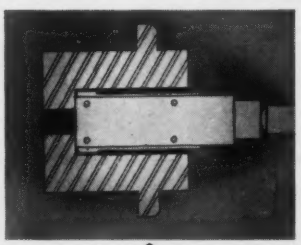
Standard stock spindle with two diametrically opposed open jets for holes having tolerances of .005" or less and surface finishes of less than 65 rms.



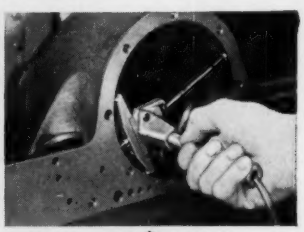
Balljet Spindles used for holes in porous or soft materials and for internal surfaces rougher than 65 rms.



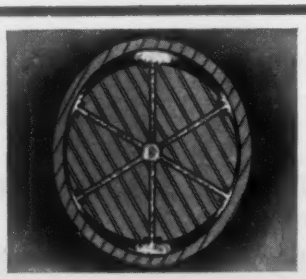
Plunjets mounted in a suitable fixture are used for larger holes and those having larger tolerances.



Bladejet Spindles are used in interrupted bores, bores having a keyway, to gage to the very bottom of a blind bore and for larger tolerance bores.



Adjustable spindles and kits are available to cover ranges of ⅜" to ⅞"; ⅞" to 1½"; 1" to 3"; 1½" to 3" and 3" to 12".



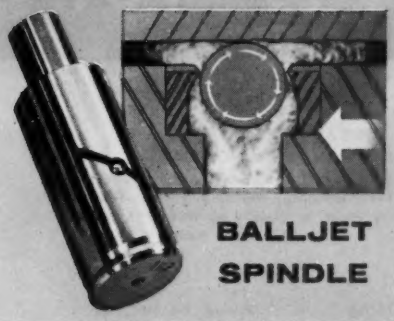
For Average Diameter

Spindles having three or more jets equally spaced around the perimeter—especially effective in checking thin wall components.

7210

MORE PRECISIONAIRES BOUGHT . . . . . .

Learn About Holes*

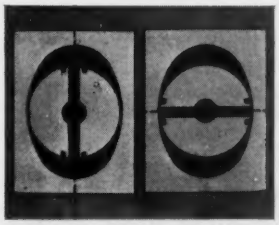


BALLJET SPINDLE

BLADEJET SPINDLE

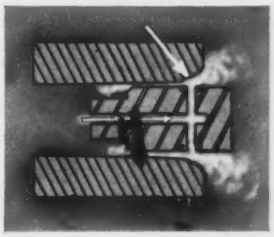
PLUNJET CARTRIDGES

For Out-of-Round



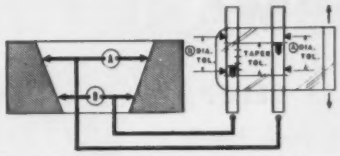
Indicated when any spindle is rotated through 90 degrees.

For Bell-Mouth



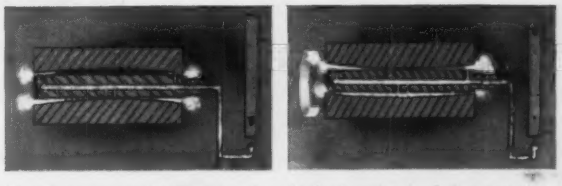
Indicated as any spindle enters or is withdrawn from the bore.

For Taper



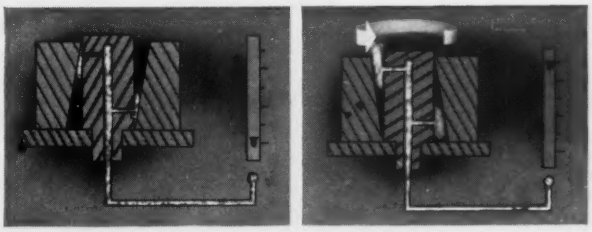
Indicated as any spindle is passed through the bore. Spindles having two or more sets of jets may also be used. In larger bores and/or those having larger tolerances, Plunjets in a suitable fixture are used.

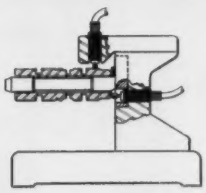
For Camber



Camber or straightness of a hole is checked by rotating through 180° a spindle having four jets as indicated.

For Squareness of a Bore Axis with a Face

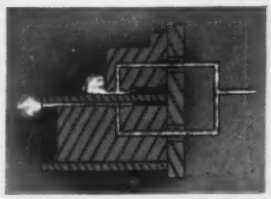




Spindle with opposed open orifices spaced longitudinally checks squareness of a bore axis with a face.

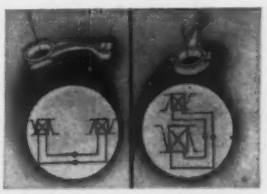
Plunjet fixtures may also be used.

For Concentricity



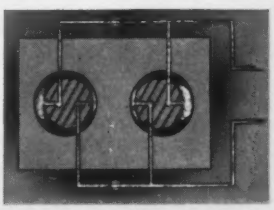
Opposed jets in a locating fixture.

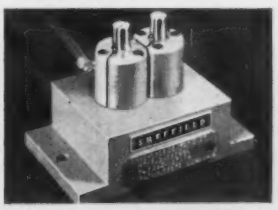
For Parallelism of Holes



By integrating two spindles in a fixture, such as those used for squareness checking.

For Center Distance Between Holes





By a fixture with two spindles each having two opposed jets.

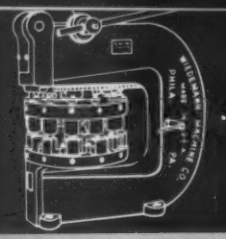
*For checking external dimensions, relationships and countless other conditions, write to Div. 600, **THE SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.**

SHEFFIELD

MANUFACTURE AND MEASUREMENT FOR MANKIND

THAN ALL OTHER MAKES OF AIR GAGES

MORE PRECISIONAIRES BOUGHT . . . . . .



WIEDEMANN *in SHORT RUN*

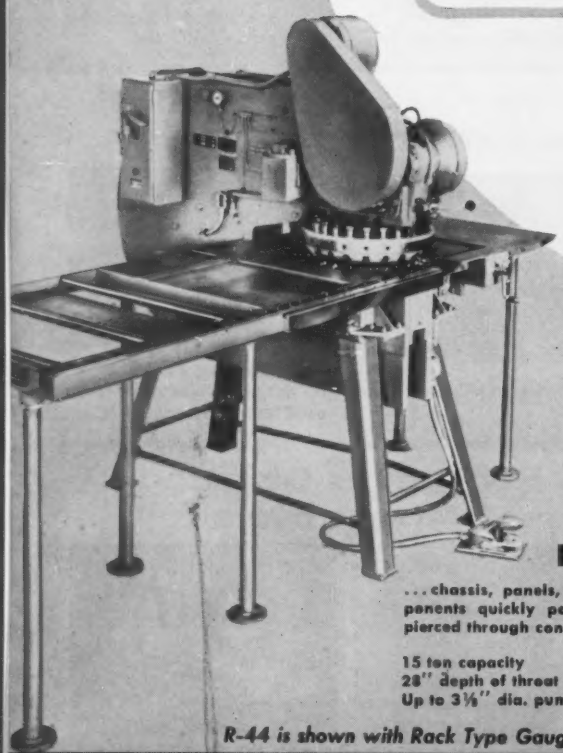
WIEDEMANN *combines in ONE machine*

1. the speed of a punch press
2. turrets carrying 12 to 32 punches and dies
3. a quick-setting, mechanical work positioning gauge

WIEDEMANN *Cuts Piercing Costs 60% to 90%*

- **ELIMINATES SETUP** — Necessary punches and dies are carried in turrets . . . any tool is rotated to piercing position in 3 to 5 seconds.
- **ELIMINATES LAYOUT** — Material to be punched is rapidly and accurately positioned with a Wiedemann work locating gauge.
- **UNLIMITED FLEXIBILITY** — Punches and dies of any shape and size can be used within the capacity of the press. A variety of openings can be made with the same punch and die.

Send drawings of your work for both time studies and recommendations on the Wiedemann Turret Punch Press and tools best suited for your needs. Every Wiedemann press is shipped completely tooled, ready to produce when leveled and connected to a power line.



R-44

. . . chassis, panels, and other flat metal components quickly positioned with a gauge or pierced through conventional templates.

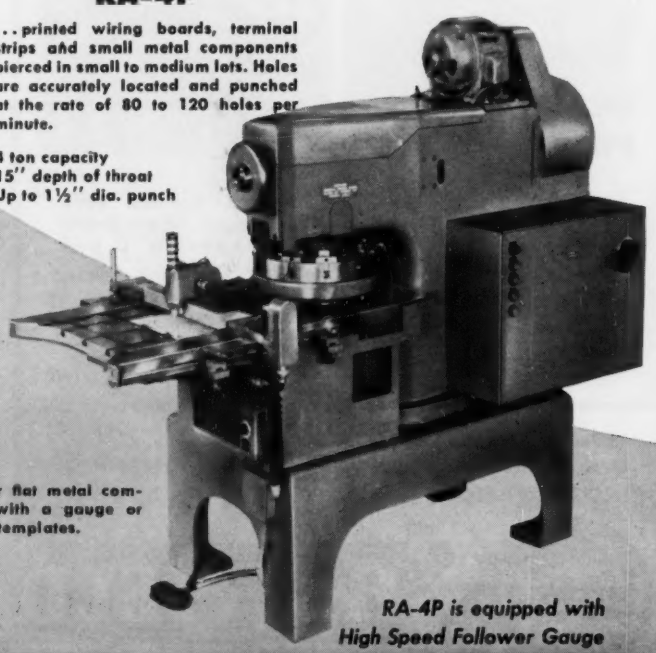
15 ton capacity
28" depth of throat
Up to 3⅛" dia. punch

R-44 is shown with Rack Type Gauge

RA-4P

. . . printed wiring boards, terminal strips and small metal components pierced in small to medium lots. Holes are accurately located and punched at the rate of 80 to 120 holes per minute.

4 ton capacity
15" depth of throat
Up to 1½" dia. punch



RA-4P is equipped with High Speed Follower Gauge

WIEDEMANN

THAN ALL OTHER MAKES OF AIR GAGES

IS THE ULTIMATE *PIERCING ECONOMY*

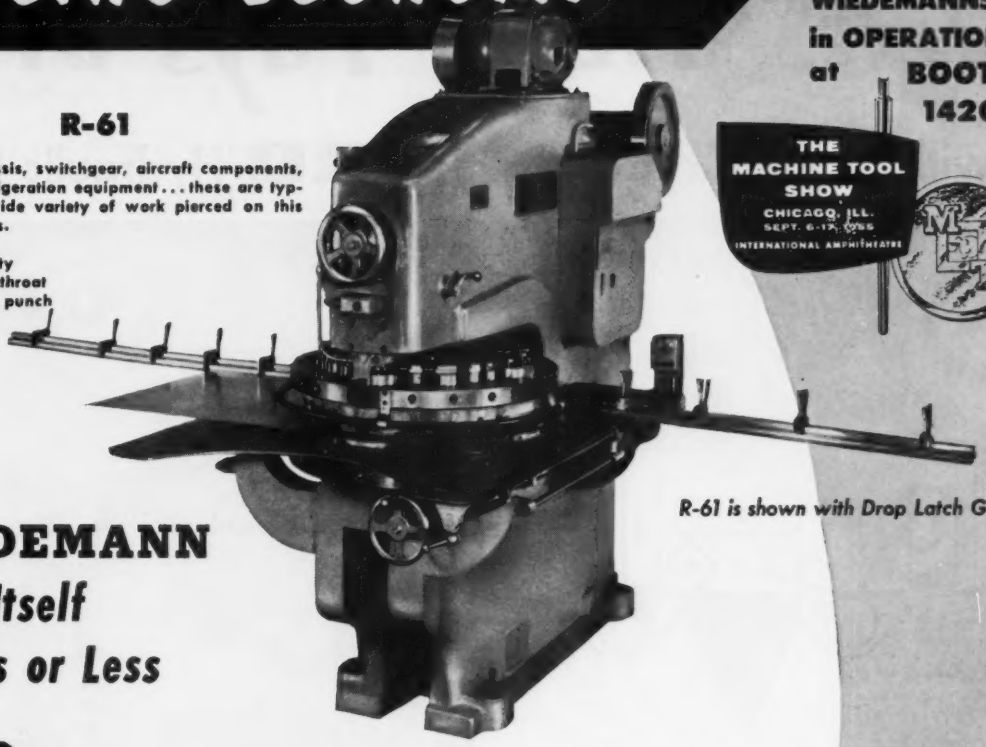
SEE 8 WIEDEMANNS in OPERATION at BOOTH 1420

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

R-61

...radar chassis, switchgear, aircraft components, industrial refrigeration equipment... these are typical of the wide variety of work pierced on this versatile press.

40 ton capacity
33" depth of throat
Up to 6" dia. punch



R-61 is shown with Drop Latch Gauge

A WIEDEMANN *Pays for Itself in 2 Years or Less*

Literature on any of these Wiedemann Presses will be sent upon request.

RA-41P

...high speed piercing of electronic chassis, panels, components and similar work.

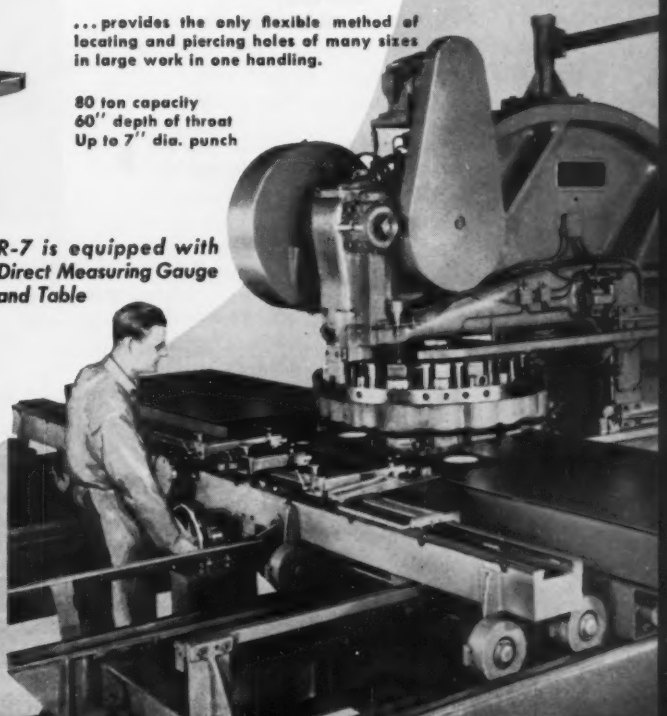
15 ton capacity
28" depth of throat
Up to 3½" dia. punch

RA-41P is equipped with High Speed Follower Gauge

R-7

...provides the only flexible method of locating and piercing holes of many sizes in large work in one handling.

80 ton capacity
60" depth of throat
Up to 7" dia. punch



R-7 is equipped with Direct Measuring Gauge and Table

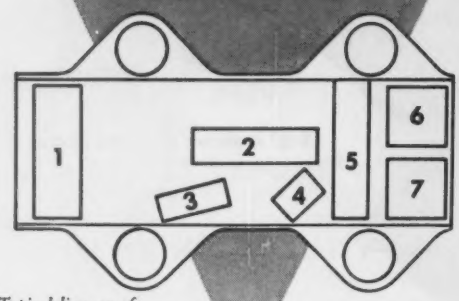
MACHINE CO.

4205 WISSAHICKON AVENUE
PHILADELPHIA 32, PA.

VERSATILITY Pays Off...

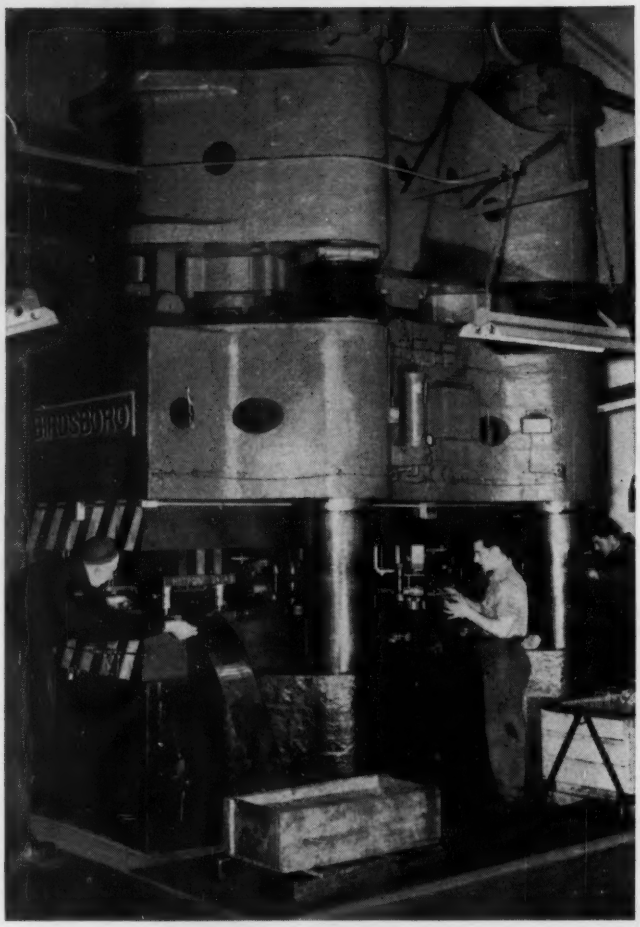
with a BIRDSBORO Hydraulic Press

7 DIES on 1 PRESS . . . produce these parts simultaneously



Typical diagram of a 7-die layout on a BIRDSBORO Hydraulic Press.

Name Plates
Escutcheons
Bezels
Radio Panels
Appliance Parts
Meter Cases
Instrument Panels



2000 ton capacity press with 60 sq. ft. of die space and 3 ft. daylight opening. Press is accessible from all four sides.

Designers and Builders of:
STEEL MILL MACHINERY
HYDRAULIC PRESSES
CRUSHING MACHINERY
SPECIAL MACHINERY
STEEL CASTINGS
Weldments "CAST-WELD" Design
ROLLS: Steel, Alloy Iron, Alloy Steel

• One BIRDSBORO Hydraulic Press can bring you high production of many different stamped metal parts at lowest cost. A single 3-man press performs blanking, piercing, trimming and embossing operations simultaneously. Saves handling of parts. Cuts labor costs. Eliminates the need for individual presses for each operation.

Accurate operating controls provide slow platen movement for test runs on new work. Safety features protect operators and equipment.

The basic BIRDSBORO press design made possible desired changes by the press user to incorporate the use of 7 dies as shown above . . . pressing out seven different parts *simultaneously*. If press versatility would pay off for YOU . . . contact BIRDSBORO engineers today.

HP 20-55

BIRDSBORO

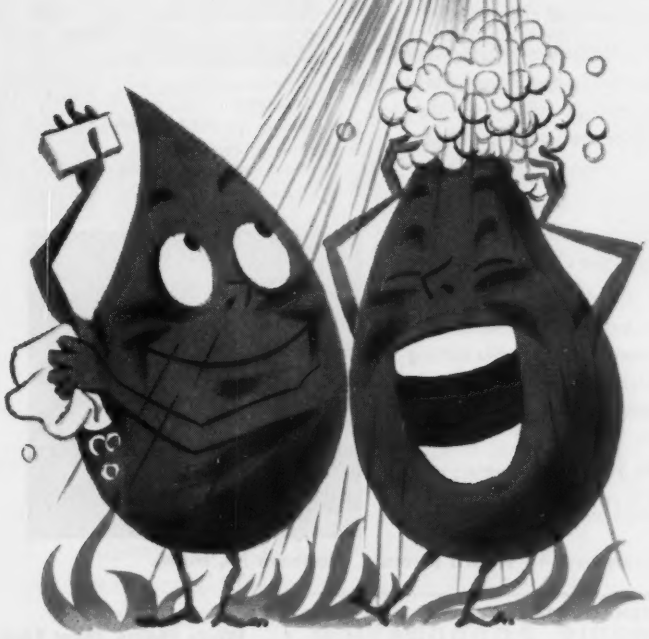
BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PENNA. Offices in Birdsboro, Pa. and Pittsburgh, Pa.

For more information on products advertised, use Inquiry Card, page 277

Now—here's
real fire prevention
for your plant . . .

New Fire-Resistant

Gargoyle NYVAC Hydraulic Fluids



Do you use hydraulic machines near furnaces, molten metal pots, red-hot steel slabs or other sources of ignition? If so, with oil in service, you have the possibility of a fire that could badly cripple your production.

New fire-resistant Gargoyle Nyvac hydraulic fluids will prevent such fires.

There are two types of these fluids—a straight synthetic fluid and a synthetic water base fluid. Both have been thoroughly proved in the field. Your particular machines and operations will dictate which product is best for your plant.

Although synthetic in composition, these new products are still designed to keep your machines running on full production schedules with low maintenance costs. They are backed by Socony Mobil's complete engineering service.

The new Nyvac fluids round out Socony Mobil's complete line of top-quality hydraulic fluids—all available from a single source of supply. Call your Socony Mobil man for complete details.

Socony Mobil *Correct Lubrication*

FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

NICHOLS TWIN MILL

two heads are better than one

. . . . for sure!

The Nichols Twin Mill is something new in duplex millers — a precision 2-spindle bed-type miller designed for simultaneous light duty milling of opposite or adjacent surfaces, using **horizontal or vertical spindles.**

The Twin Mill provides unmatched flexibility! It is equally adaptable for long-run or short-run jobs. The two geared milling heads are independent units, with separate 1 HP motor drives, and are quickly adjusted either directly opposed or offset longitudinally, vertically or transversely. Set-up is fast and simple.

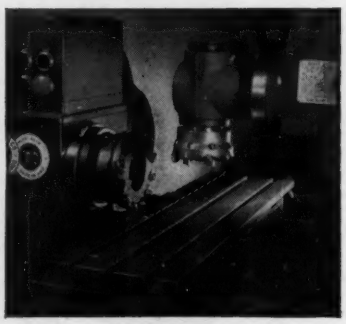
The wide range of spindle speeds from 55 to 2050 R.P.M. allows milling of ferrous or non-ferrous materials with high speed or carbide tipped cutters, producing EXTRA FINE FINISH while maintaining the closest tolerances with ease.

The Twin Mill is completely push-button controlled, arranged for automatic table cycling — with rapid approach, hydraulically controlled variable cutting feed and rapid return. Available with automatic retraction of milling heads, automatic spindle brakes and carefully engineered special features to meet specific applications.

The parts shown are typical of those on which the Twin Mill is cutting costs and boosting production. Investigate the savings it can make for you. For details write to Nichols-Morris Corporation.

CONDENSED SPECIFICATIONS

Table, working surface	8⅝" x 30"
Table Travel—cutting stroke	11¾"
Motors	(two) 1 HP
Spindle Speeds (15)	from 55 to 2050 RPM
Max. height center of spindle above table	11¾"
Max. offset of spindles (horizontal)	8½"
Max. distance between spindle noses (across table)	16"
Floor space required	64" x 56"



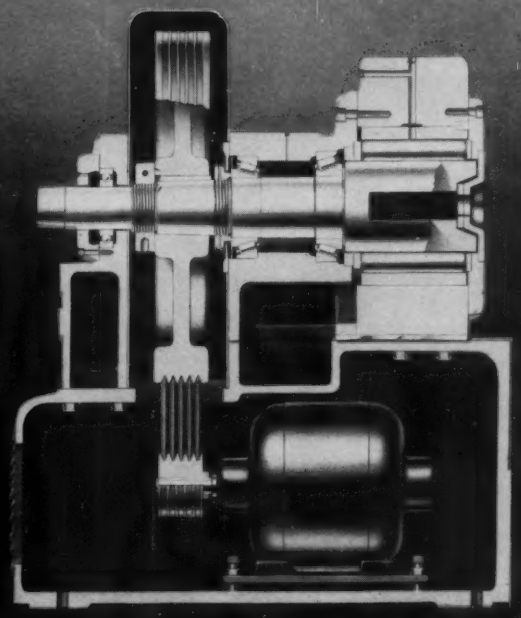
Manufactured by W. H. Nichols Company, 48 Woerd Avenue, Waltham 54, Mass.

76-E Mamaroneck Ave. NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION** White Plains, New York

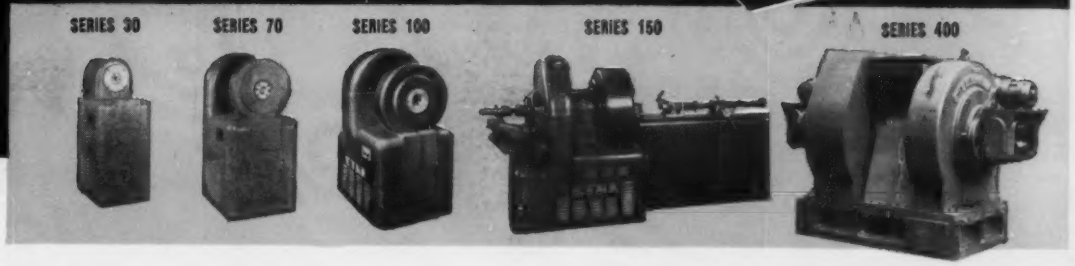
For more information on products advertised, use Inquiry Card, page 277

IF IT'S SWAGING... It's Etna..

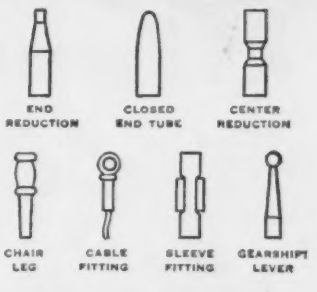
FOR CONTINUOUS PRECISION PRODUCTION!



A COMPLETE RANGE OF SIZES AND CAPACITIES



For tapering, sizing, reducing and forming to special shapes of round solids and steel tubing, the Etna Swaging Machine offers the ultimate in modern machine design. Regardless of size and description of the job to be done, there's an Etna swager right for *greater production*. Write today regarding your specific job problems.



It's New! Get full information on the blending into the wall of I. D. Bead on steel and stainless steel tube with Etna Swagers resulting in mirror finish. Bead also removed on conduit.

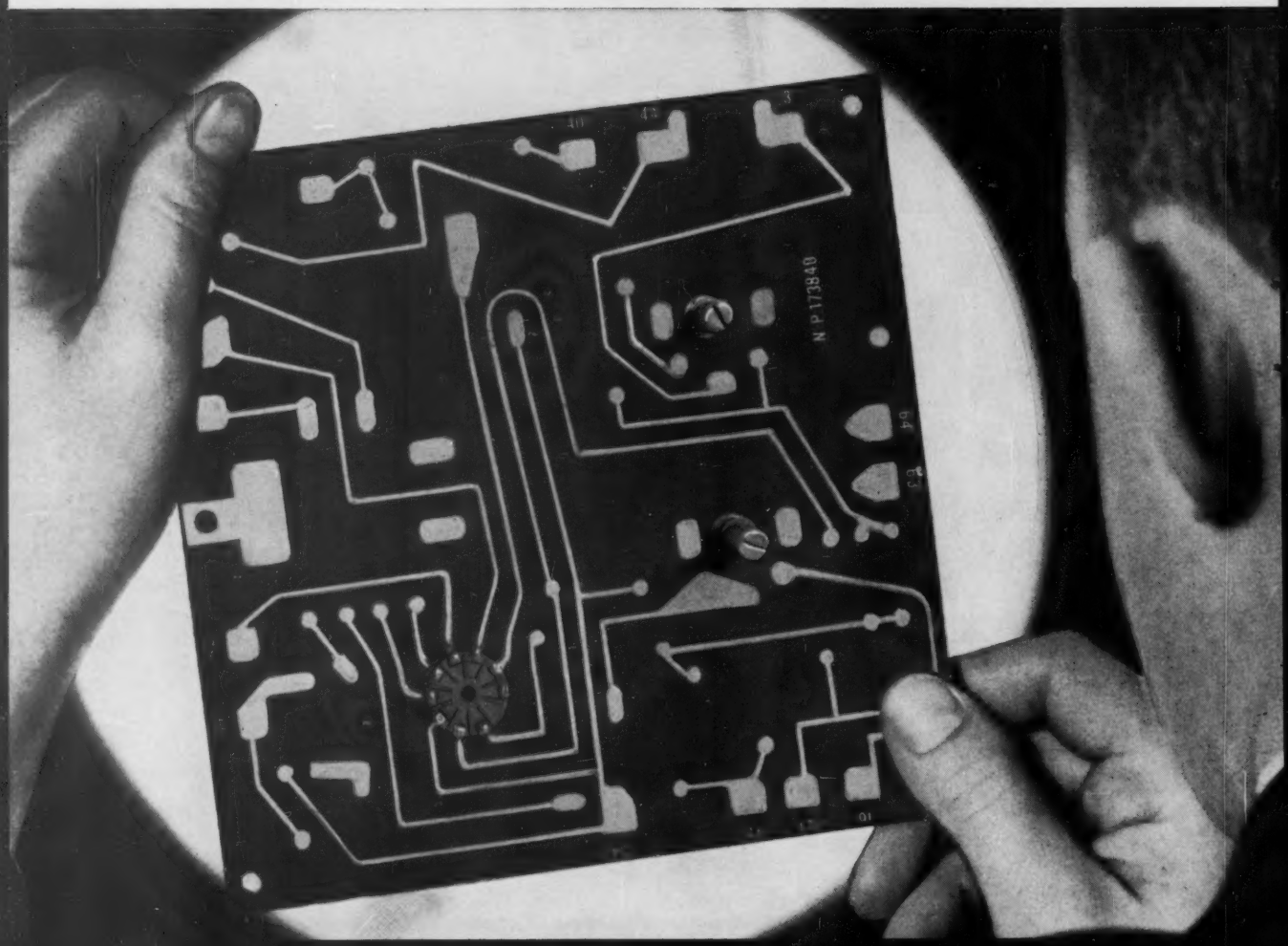
Abbey ETNA Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO

For more information on products advertised, use Inquiry Card, page 277

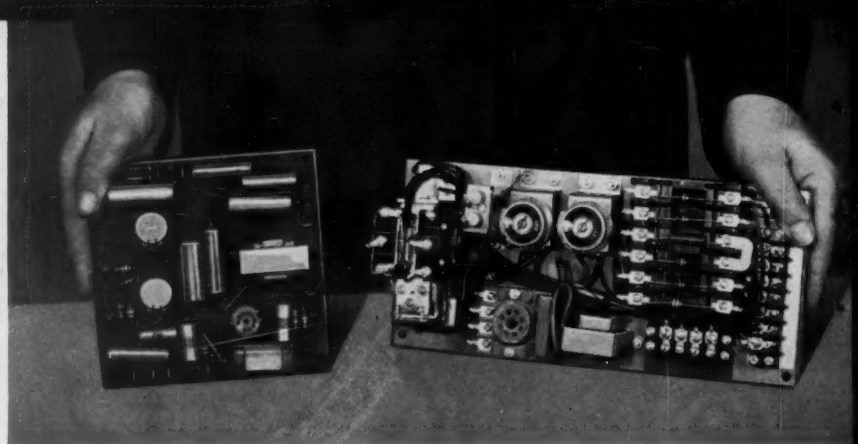
GENERAL ELECTRIC ANNOUNCES . . .

NEW, Low-price Thy-mo-trol*



Printed Circuits—or "wireless" circuitry—constitute the "brains" of the new general purpose Thy-mo-trol Drives. Simply, it is a method of printing an electrical diagram on the back of a sturdy, lightweight plastic board. The electrical "track" or diagram is made of solder-covered copper strips.

All circuit components within the "brain" are connected without the use of wiring! A protective coating is sprayed over the entire printed circuit. All connections to the control circuits are of the simple "plug-in" type, making attachment and removal of connecting circuits a simple, hand operation.



"Brain" of new Thy-mo-trol Drive—printed control circuits. Top photo shows printed electrical diagram. G.E.'s industrial adaptation of this process helps reduce size and complexity of circuits. In lower photo, new at left, conventional at right.

Drive with Printed Control Circuits

NOW! GET RELIABLE, SMOOTH, ADJUSTABLE SPEED FOR MACHINE TOOLS IN A SIMPLIFIED, LOW-PRICED DESIGN

Designed for quality performance, reliable operation, easy maintenance, and at a new low price, a new and simplified line of general purpose Thy-mo-trol Drives has been developed by General Electric. These drives represent a new and far-reaching step in electronic adjustable speed.

An approximate 20% price reduction under the line it replaces is possible because G-E has successfully simplified the entire control system and has adapted printed control circuits into the Thy-mo-trol panels. New Thy-mo-trol design allows a substantial reduction in *weight, size, circuit complexity, wiring, maintenance costs and installation cost.* The new design is now available in two ratings: ¾ to 1 hp and 1½ to 3 hp—making your choice of an adjustable speed drive to meet specific needs that much easier.

Operating directly from a-c power, the new standard Thy-mo-trol Drive includes an electronic control panel, a d-c motor, and a push-button station. No anode transformer is necessary if operated on 440 volts, 50 or 60 cycle, single phase power. Separately mounted auto-transformers are supplied as a standard feature for voltages other than 440.

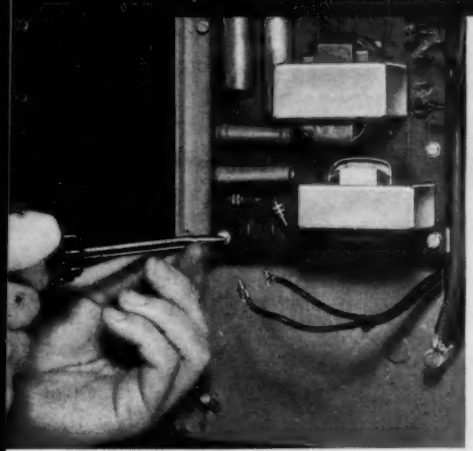
The new drive is rated at constant torque over the entire speed range. Speed range is 8 to 1 for continuous duty with higher ranges possible for special applications. Optional modifications include jogging, reversing, tachometer feedback, reactor loop control, and external current limit adjustment.

For more information on this outstanding new adjustable speed drive, contact your nearest G-E Apparatus Sales Office or write for Bulletin GEA-6234, General Electric Company, Section 791-1, Schenectady 5, New York.

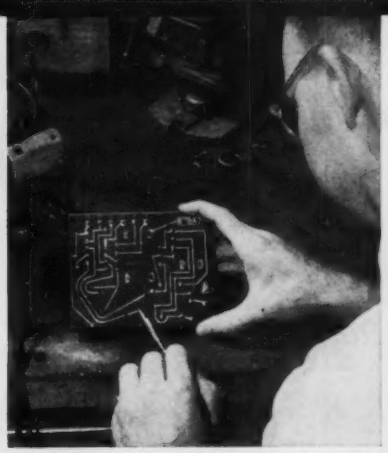
Progress Is Our Most Important Product

GENERAL ELECTRIC

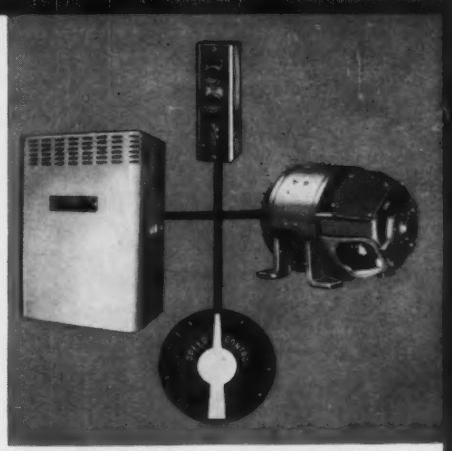
**Registered Trade-mark of General Electric Company*



Easily attached or removed. Only a screwdriver is needed. Plugs and terminals are numbered for easier service.



Simplified repair. Component replacement is fast and easy—a simple bench operation. No need to discard entire unit.



Three basic units. DC motor, pushbutton station, and panel containing tubes and "brain" make up new Thy-mo-trol Drive.

THE NEW 100 SERIES

BOSTON Gear

again sets the standard for cost-wise speed conversion

The New 100 SERIES Reductors and Ratiomotors are designed for peak efficiency and new economy by industry's largest, most experienced manufacturer of standard STOCK speed reduction units . . . BOSTON Gear.

You can select 100 SERIES Reductors and Ratiomotors with complete confidence that they set new performance standards, reduce costs, save space and weight, and simplify your job of product design.

Listed output of 100 SERIES units is certified by BOSTON Gear to be actual torque delivered, as determined in *Independent Laboratory* tests. Design around the 100 SERIES. Give *your* product the *extra value* of speed reduction units that deliver

Certified

MAXIMUM HORSEPOWER PER DOLLAR
by actual test!

REDUCTORS

NEW space-saving design
NEW clean contours
NEW gearing efficiency
NEW cooling fins
NEW maintenance savings
BOSTON GEAR quality

FAN-COOLING
Optional on larger sizes

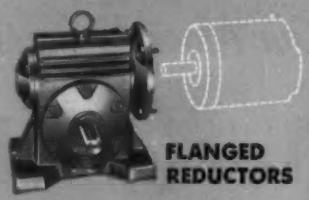
RATIOMOTORS

NEW *Combination* DESIGN

Simplified construction combines independent reduction gear unit with easily detachable, standard end-mounted motor for easy maintenance. Permits . . .

1 Replacement of motor without disturbing reduction gear unit.

2 Replacement of original motor at any time with motor of special characteristics (totally enclosed, explosion-proof, etc.).



FLANGED REDUCTORS

are the reduction gear units of Ratiomotors supplied to you without motor. You buy and attach any end-mounted motor you choose. Flanged Reductors are made in the same range of models and ratings as Ratiomotors.

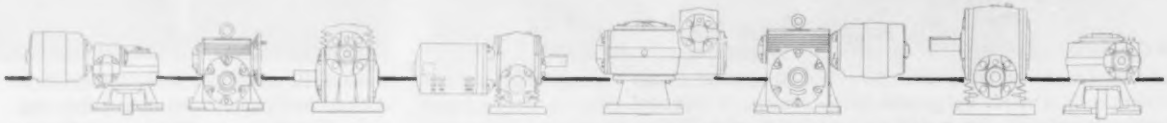
55BG-R-12

CALL YOUR BOSTON Gear DISTRIBUTOR

GET NEW CATALOG R-56

Gives complete information, selection charts, engineering data. Ask your BOSTON Gear Distributor, or write: Boston Gear Works, 65 Hayward St., Quincy 71, Mass.

108 MODELS — 1064 DIFFERENT UNITS — FROM STOCK — FOR ANY DRIVE



For more information on products advertised, use Inquiry Card, page 277

just 12 seconds from this to this

with the help of

AUTOMATION

by LAPOINTE

BROACHING

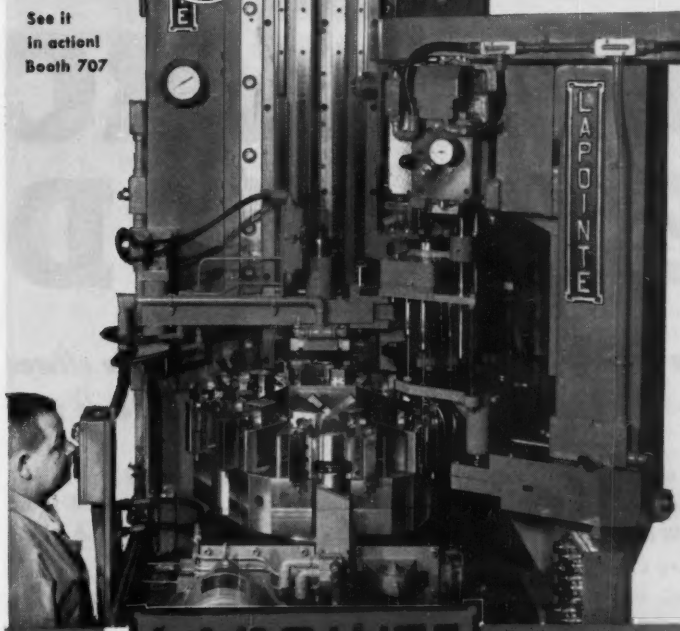
A PARKING BRAKE PAWL forging is straddle-broached to form a straight-sided tooth on one edge and a slot on the opposite side . . . and then 2 holes are drilled and reamed at close tolerances with relation to broached surfaces . . . at a production rate, for the finished part, of

300 PER HOUR

AT 80% EFFICIENCY!

THE MACHINE TOOL SHOW CHICAGO, ILL. INTERNATIONAL AMPHITHEATRE

See it in action! Booth 707



This Lapointe 10 ton, 54-inch stroke Single Ram Vertical Broaching Machine is equipped with an **automatic indexing fixture.** Parts are progressively moved in pairs through 6 double-stations, and the broaching, drilling, and reaming operations are done simultaneously but on separate pawls.

If you wish to know more about increasing your production through broaching,

write for our Bulletin SRV-1.

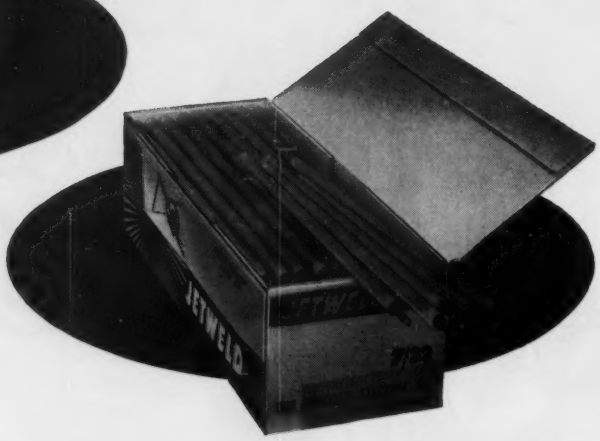
THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U. S. A.

In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

Welding industry's greatest cost-cutting twins . . .



IDEALARC and JETWELD

Never before has any combination of welder and electrode offered such a cost-saving potential in faster, easier welding. Here's why:

Idealarc for easy, efficient operation . . . first welder to give you *both*
AC AND DC WELDING CURRENT
with Dual Arc Control where you select "soft arc" or "forceful arc" on AC as well as DC
and in addition . . . hot starting on DC as well as AC

Jetweld for high-speed operation . . . first universally adopted iron-powder electrode for
extra-fast welding
high deposition
drag operation

LET LINCOLN DEMONSTRATE HOW YOU CAN PROFIT . . . NOW. Send for Bulletin 1343. Write . . .

THE LINCOLN ELECTRIC COMPANY
Dept. 1204 • Cleveland 17, Ohio
The World's Largest Manufacturer of Arc Welding Equipment

For more information on products advertised, use Inquiry Card, page 277

DOWEL PINS

HOW TO USE THEM

1. Precision Dowel Pins are principally used where parts must be accurately positioned and held in absolute relation to one another whether stationary or in motion. They facilitate quick disassembly and completely accurate re-assembly.

2. Allen Dowel Pins are also used as plug gauges.

3. As plugs for determining angular dimensions of dovetail slides.

4. As hinge and wrist pins in applications requiring initial and permanent accuracy.

5. As accurate, economical roller bearings and axles.

6. As guide pins, stops and position locators.

HOW TO JUDGE THEM

1. *On precision, for low tolerance applications.* (Allen Dowel Pins are ground to a maximum microinch finish of 6 RMS protected by a rust preventive.)

2. *On strength, for shear resistance.* (Allen Dowel Pins are made from special Allenoy Steel, heat treated. Single shear strength measures from 160,000 to 180,000 psi.)

3. *On hardness of surface and a core hard enough to prevent "mushrooming" when driven into a tight hole.* (Allen Dowel Pins have a surface hardness of 62-64 Rockwell C Scale and core hardness of 52-54. Average case depth .010 to .020 depending on size.)

The simple sure way to be sure of uniformly superior dowel pin quality is the same as in buying precision socket screws — *get genuine Allens from your Industrial Distributor.* Only he sells them but *we will welcome your direct request for literature or application engineering assistance.*

ALLEN HEAD

ALLEN

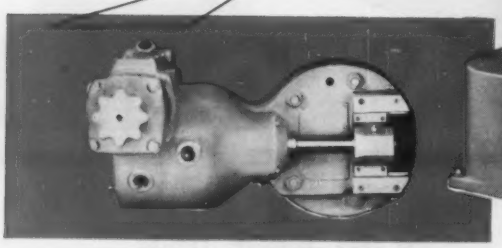
MANUFACTURING COMPANY

Hartford 2, Connecticut U.S.A.

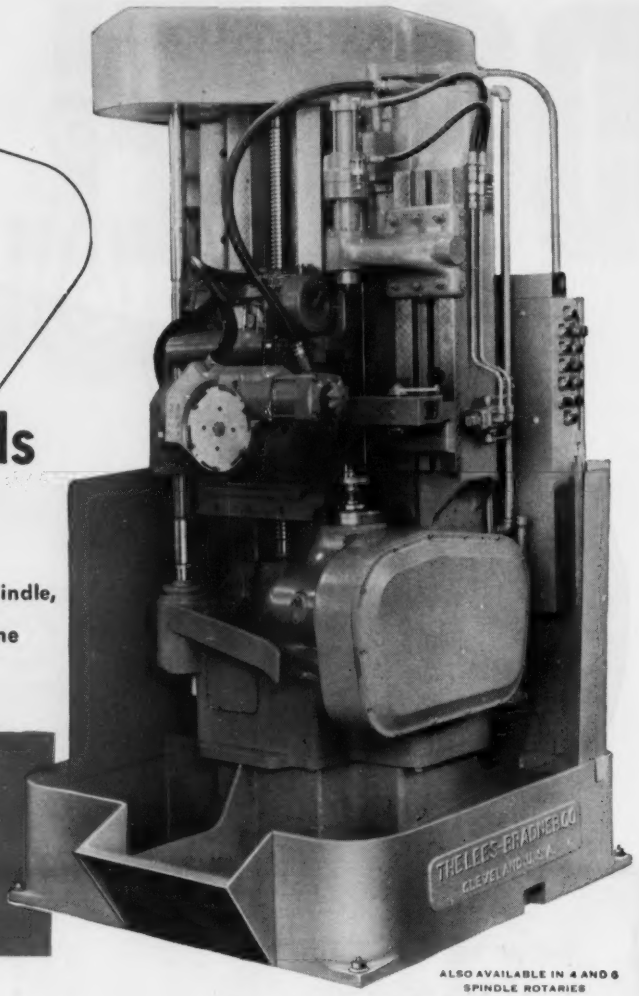
Available in 108 Standard Sizes from ⅛" x ⅜" to 1" x 6". Standard tolerance .0002 oversize. Most sizes also standard in .001 oversize for repair work.

Hob today at tomorrow's speeds

with the new Lees-Bradner Model 7, Type HD Single Spindle, High Speed Hobbing Machine



Close-up shows new, heavier hob head with Timken bearing construction, 3-inch hob shift and new outer support.



ALSO AVAILABLE IN 4 AND 6 SPINDLE ROTARIES

Capacity TODAY to meet tomorrow's production requirements is a built-in bonus feature of Lees-Bradner Hobbing Machines.

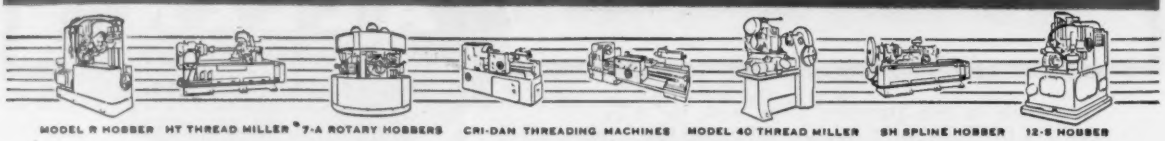
The new Model 7, Type HD Single-Spindle High Speed Hobber for example, is a heavier, faster machine than its prototype. Weighing approximately 1,000 lbs. more, a heavier headstock and heavier column gives you the added rigidity to perform better and faster the excellent job done by its predecessor, the Type "A".

Designed-in production capacity to take care of tomorrow, as well as today, offers savings in time and labor. To industry, constantly pressed for higher production, these savings mean more than dollars. They mean *satisfied customers.*

For the whole story and a demonstration, contact your Lees-Bradner representative. Or, write us direct.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U. S. A.



MODEL R HOBBER · HT THREAD MILLER · 7-A ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · 9H SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

For more information on products advertised, use Inquiry Card, page 277

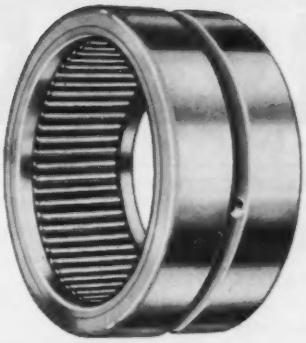
Which of these ORANGE ROLLER BEARINGS is best for your application?

Look over this "family" of Orange Roller Bearings. Each type is designed to provide outstanding performance under specific conditions. When matched to your operating requirements, they can solve many design problems—cut costs—save space—speed up assembly—provide quiet, long-life, trouble-free operation.

- Submit details or drawings for recommendation
- Field engineers available for consultation
- Engineering Data Books sent on request

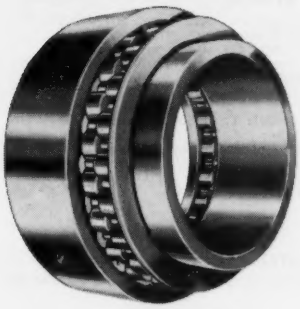
ORANGE ROLLER BUSHINGS

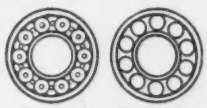
Maximum load capacity in small space



Install these space-saving full-type needle bearings to provide friction-free, long-life operation of rotating or oscillating parts. Electronically-gauged rollers permit closer internal running clearances, minimizing possibility of misaligned rollers. Quiet, even-running. Stock sizes ½" to 8" shaft diameters.

For heavy loads—severe service ORANGE "STAGGERED" ROLLER BEARINGS





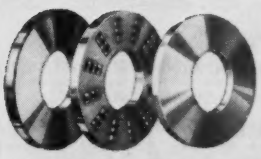
Staggered Conventional

End views show how staggered roller arrangement distributes load over many short rollers, compared with conventional bearings. Often permits use of smaller bearings—always assures longer service life. Also prevents skewing tendencies of long rollers, provides more even running. All standard, fully interchangeable sizes.

ORANGE *Cage Type* NEEDLE BEARINGS

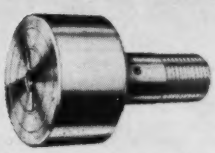
Prevent Roller Skewing

Anti-friction cage keeps rollers permanently aligned and true-running in any position—vertical, tilted, horizontal. Successful on overhung mountings and relatively high-speed installations. Less affected by misaligned mountings or uneven loading. Extremely smooth, quiet running. Sizes ½" to 8" shaft diameters.



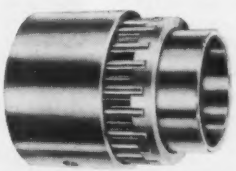
ORANGE THRUST ROLLER BEARINGS

Designed to provide maximum roller support for the load, with minimum wear. Available in designs and sizes to meet varying requirements.



ORANGE CAM FOLLOWERS

Compactly designed for high anti-friction protection under heavy load and intermittent shock. Available with standard or heavy studs, according to application.



ORANGE JOURNAL ROLLER BEARINGS

Provide high load capacity where radial space is limited, such as shafts close together or adjacent to shoulders. Available complete or component parts. Sizes ¾" to 5" shaft diameters.

ORANGE ROLLER BEARING CO., Inc.

552 Main St.

Orange, New Jersey

ORANGE

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

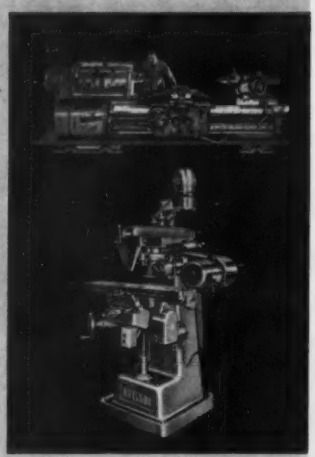
ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Dv., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St Ansonia, Conn.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

Foaling a new Champion

A new champion has been added to the Axelson family of machine tools by the purchase of the Fray Milling Machines and Milling Attachment from the Fray Machine Tool Company, Burbank, California.

Axelson will manufacture the milling machines and milling attachments with the same special skills and craftsmanship that have made Axelson Heavy Duty Lathes world famous for outstanding quality.

May we give you more information?



Axelson
Milling Machines

AXELSON MANUFACTURING COMPANY
Division of U.S. Industries, Inc.
6160 So. Boyle Avenue,
Los Angeles 58, Calif.

Authorized dealers in principal industrial centers.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Almond, T. R. Mfg. Co., 4621 Beidler Rd., Willoughby, Ohio
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chcago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 322)

CUSHMAN chucks

give Chuck-ability

CHUCK-ABILITY — The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices.

the key to machining efficiency

One of the Cushman Jet Engine Chucks.

Efficient machining of jet engine parts of large diameter and small cross-section to extremely close tolerances without strain or distortion was materially improved by the Cushman series of special chucks designed and built for this purpose. These chucks completely overcome the inherent difficulties of the operations and permit mass production of these vital component parts. The success of these new chucks is one more proof that Cushman gives Chuck-ability as an essential to efficient production.

Manufacturers throughout the country have long recognized and used the Cushman Engineering Department for solutions to chucking problems. We invite you to use this experienced service.

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut
a world standard for precision

CUSHMAN the CHUCKMAN CHUCKS 1867

SEE YOUR INDUSTRIAL DISTRIBUTOR

manufacturers of:

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

2C555

Wing
REVOLVING
UNIT HEATERS
The Moving Airstream
Touches the Worker
for only a few Seconds
at a Time
NO SICKENING HOT BLAST!
That is the big difference between all other unit heaters and the WING Revolving Heater. The soft airstream from the slowly revolving discharge outlets creates a warm, gentle, yet live sensation of comfortable well-being that is without equal for keeping workers contented and productive.
...And in the Summertime with the steam turned off and the fans on, these same revolving discharge outlets will create a pleasing, cooling effect on the hottest days.
L. J. Wing Mfg. Co.
183 Vreeland Mills Rd., Linden, N. J.
Factories: Linden, N. J. & Montreal, Canada
In Europe: Etab. Wanson, Brussels, Belgium
Wing
L. J. Wing Mfg. Co., Linden, N. J. MA-6
Please send me Bulletin HR-6A-Revolving Heaters
Name
Firm
Address
City Zone State
UNIT HEATERS
FANS
BLOWERS
DRAFT INDUCERS
TURBINES

BABBITT
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T. & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

BALL BEARING TESTERS
Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

BALLS
Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel
Allegheny Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Rooler Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded
Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt
Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
Bunting Brass & Bronze Co., Spencer & Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.

(*Continued on page* 324)

For more information on products advertised, use Inquiry Card, page 277

NOTHING LIKE A REFRESHING DIP . . . and when unplated Vaco Screwdrivers take this dip in Cities Service Anti-Corrode, they're fresh for the next 12 months . . . completely protected against rust and corrosion. Brand new finish, brand new sales appeal. Vaco operates world's largest plant exclusively for manufacturing of screwdrivers.

Screwdrivers take bath that lasts a year!

Bath in Cities Service Anti-Corrode Protects Vaco Screwdrivers Against Rust for 12 Months

The Vaco Products Company of Chicago, Illinois operates the world's largest plant devoted exclusively to manufacturing screwdrivers. Obviously, they cannot afford rust . . . whether screwdrivers are in storage or en route to a customer . . . this is particularly true of special orders for those blades which are not plated.

That's why Vaco uses Cities Service Anti-Corrode #27 on these special order blades. They've found this unusual product prevents rust during transportation and storage.

Whether you're concerned with storage, protection en route or product display, you'll find Cities Service Anti-Corrodes the ideal rust preventives for your business, too. For information, contact your nearest Cities Service representative or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

in Stainless Steel Tube Sheet

Illustrated is a rugged drilling operation that uses the durability and cutting speed of standard Whitman & Barnes High Speed Drills. This 446 stainless steel tube sheet for a special heat exchanger in a chemical plant requires 602 holes 2 11/16" in diameter be drilled through the 2½" depth of the sheet. W & B drills are operated without regrinding for approximately four hours at 69 R.P.M. and with .012" feed. For the best in drilling performance on your every operation—specify W & B.

Call your **W&B** *distributor for best service and highest quality*

He can save you money by supplying from his stock . . . what you need when you need it!

"Makers of Fine Tools Since 1848"

W&B

Please send me additional information

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

WHITMAN & BARNES

PLYMOUTH, MICHIGAN

NEW YORK • CHICAGO • LOS ANGELES • ATLANTA

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Roolway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self-Lubricating (Oilless)
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa

BELTING, Transmission
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

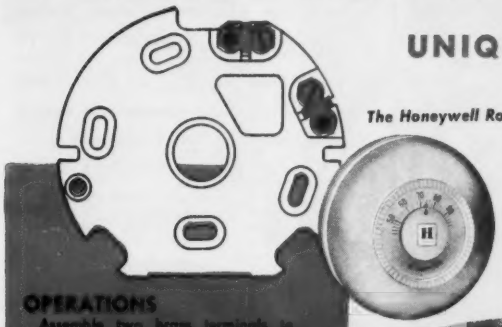
BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

(*Continued on page* 326)

For more information on products advertised, use Inquiry Card, page 277

Bodine CASE HISTORY NO. 40

UNIQUE TOOLING SAVES 90% LABOR



The Honeywell Round

OPERATIONS

Assemble two brass terminals to plastic back plate. Tap 3 holes—auto-feed & insert two screws. Inspect for screws & terminals.

PRODUCTION DATA

Previous method, 8.5 hours labor per 1M assemblies. New method, 0.81 hours labor. 7.69 labor hours saved per 1M assemblies. Machine runs 1,500 cycles per hour. Acceptability of production 94%.

Minneapolis-Honeywell's attractive room thermostat depends upon this unique tooling set-up for economical volume production of the plastic back plate terminal block assembly shown at left. Labor hours have been reduced to about ONE TENTH of previous operations, thanks to this Bodine 42-30 Machine. It's just one example of the versatility of Bodine machines as they lend themselves for special tooling to meet specific job requirements.

UNUSUAL TOOLING FEATURES: This complete assembly is now made in one cycle of a Bodine 42-30 Machine. The two presses stamping the terminal blanks are coupled to and cycled by the machine, feeding stampings continuously as shown. Terminals are cut-off, inserted and formed over at station one. Back plates are magazine fed. Operator's functions are largely limited to keeping back plate magazine filled and replenishing coils of brass stock on presses.

At end of operation, two inspection probes, advanced from below, test for properly filled screw terminal holes, automatically discard rejects.

With today's demand for cost-saving through grouping of assembly operations, Bodine's extensive experience in the field will prove profitably useful. We invite inquiries. Send your ideas and samples for analysis to Dept. M-6.

"You Can't Meet Tomorrow's Competition With Yesterday's Machine Tools."

You're Invited . . .

to visit us at the National Machine Tool Show, International Amphitheatre, Chicago, Ill., Sept. 6-17 incl. *Bodine Booth #209.*

THE Bodine CORPORATION

BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

6BD33

Clamp power to production

Models MTU (above, left) and MTS (above, right) Multiple Plate Clutches are available in dry or oil types. Sizes 3" to 12", working capacities .47 to 44 hp per 100 rpm. Request Bulletin 134-B.

Design Twin Disc Models MTU, MTS Multiple Plate Clutches into your machines . . . *and you provide the capacity to effectively transmit higher loads required for maximum production.*

With comparatively *low* pressure on the control lever, Twin Disc Multiple Plate Clutches provide *high* clamping efficiency. Add their *short* travel, and you have minimum clutch length . . . *permitting high torque capacity to be designed into minimum space.* To maintain high torque capacity, the Models MTU, MTS feature materials with high friction coefficient, plus an ample number of friction surfaces.

Also important, Twin Disc Multiple Plate Clutches permit higher speeds of rotation, for their operating mechanism is designed to be *unaffected* by centrifugal action. Adjustment is single-point for time-saving simplicity. All sliding surfaces are specially hardened to eliminate possibility of scoring parts.

Whatever your requirement, Twin Disc can provide the right type, right size Multiple Plate Clutches for greater efficiency. The Models MTU (duplex) and MTS (single) are mechanically-actuated. New Twin Disc Models MOD (duplex) and MOS (single) Multiple Plate Clutches are oil-actuated, with the floating or pressure plate acting as the cylinder ram.

Be sure to write Twin Disc Clutch Company, Racine, Wisc. today for detailed information.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC
Friction Clutches and Fluid Drives

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

Branches or Sales Engineering Offices: Cleveland • Dallas • Detroit • Los Angeles • Newark • New Orleans • Seattle • Tulsa

BENDING MACHINES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg Co., Chambersburg, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machne & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

BLAST CLEANING EQUIPMENT

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Wallis Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

BLUING LAYOUT

Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS

Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

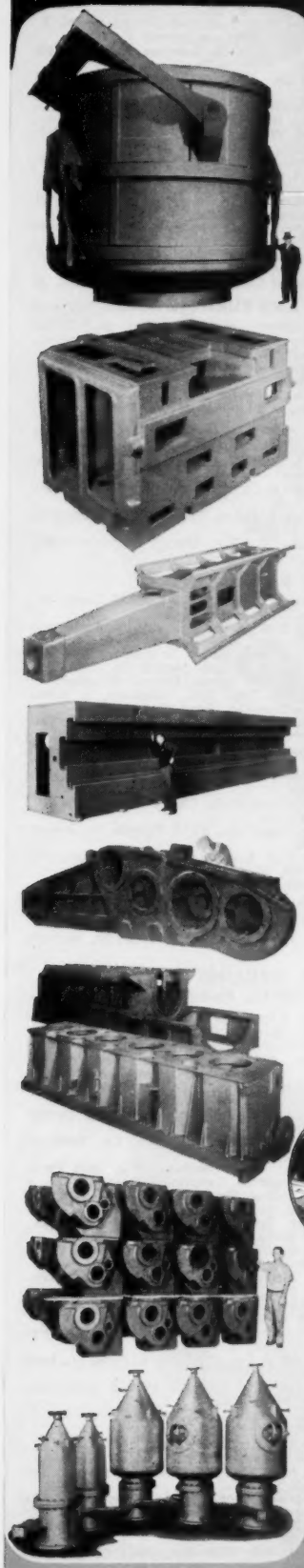
BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.

(*Continued on page 328*)

For more information on products advertised, use Inquiry Card, page 277

Steel-Weld FABRICATION



Use WELDED STEEL for Greater Strength with Less Weight!

Precision machining operations on heavy cumbersome pieces, such as the base and cover of a 200,000 kw Steam Turbine illustrated above, are not uncommon in the Steel-Weld Division of the Mahon Company. Mahon service to manufacturers of processing machinery, machine tools, and other types of heavy mechanical equipment is complete in every respect: Design-engineering, Fabrication, Magnetic and Radiographic Inspection, Stress Relieving, Grit Blasting, Machining and Assembling. If you use weldments in your product, or if parts of your product could be produced to better advantage in welded steel, you will find in the Mahon organization a unique source . . . a source where design skill and advanced fabricating technique are supplemented by craftsmanship which assures a smoother finer appearing job embodying every advantage of Steel-Weld Fabrication. See Sweet's Product Design File for information, or write for Booklet showing Mahon facilities and capabilities in this field.

THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON

What is done is DONE... on the GOSS & DeLEEUW

AUTOMATIC CHUCKING MACHINE

There are no half-finished pieces lying around at the end of the day when you put your work on this outstanding machine.

The "1-2-3" feature—available only on the Goss & De Leeuw Automatic Chucker —provides the means of finish machining three ends of a part without changing set-up.

Note some of the typical parts machined. Ask for illustrated literature giving further details and send samples of your work for a cost estimate on handling it on the Goss & De Leeuw.

GOSS & DeLEEUW QUALITY PRODUCT-QUANTITY PRODUCT

GOSS & DeLEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Portage Machine Co., 1069 Sweitzer Ave., Akron 11, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

(*Continued on page 330*)

For more information on products advertised, use Inquiry Card, page 277

How a shift in gears saved $256,000

Five million MUELLER BRASS CO. forged ring gears improve automatic transmission operation . . . at lower cost to the manufacturer.

Ever since one of the leading manufacturers of automotive transmissions began using ring gears forged from Mueller Brass Co. bearing bronze, production costs have been cut nearly $256,000. That's because the rough forging weighs less and is closer to finished size than a sand cast ring gear formerly used. This shift in gears resulted in a savings in metal costs, greatly reduced machining time and increased tool life. In addition, the use of forged gears has cut scrap loss and eliminated costly inspection rejects.

The performance of these forged ring gears is also far superior to the sand cast gear, which had a tendency to flake away and crack around the teeth, causing failures. More than five million forged ring gears have now been used in these transmissions without a single failure. Being porous, the sand casting was difficult to balance, but the forging has a dense, homogeneous structure that helps keep it in perfect balance.

Strong, long-wearing non-ferrous metal parts, forged to your specifications by Mueller Brass Co., can help reduce your costs and improve the performance of your products just as they have done in this transmission application. For complete information, write us today.

Write today for your complete set of Mueller Brass Co. engineering manuals.

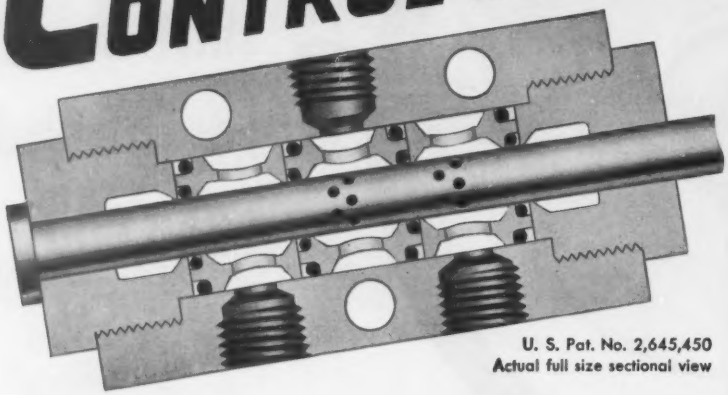
MUELLER BRASS CO. PORT HURON 35, MICHIGAN

154

NEW, INEXPENSIVE, HIGHLY EFFICIENT

Quick-As-Wink®

CONTROL VALVE

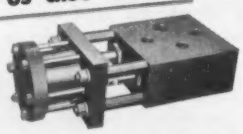


U. S. Pat. No. 2,645,450
Actual full size sectional view

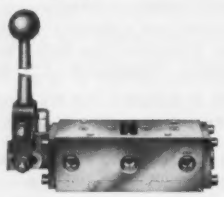
COMBINES greatly simplified construction, positive positioning of all parts, and quick and easy repacking in the field.

• Internal spacers are held firmly and accurately in metal to metal end abutment when the gland nuts are tightened, holding the "O" rings in correct position, without subjecting them to any mechanical pressure. Flow is from the inlet chamber through the hollow, radially ported, stainless steel plunger, and out the connected line. No direct impingement of flow across the packings, greatly prolonging their life. ⅛" or ¼" pipe connections. 2, 3, 4 or 5-way actions. Push-pull; push, spring return; lever; foot; cam; pilot; diaphragm and single and double solenoid designs. Write for Bulletin No. 531 today! *It gives full details.*

Ask us also about . . .

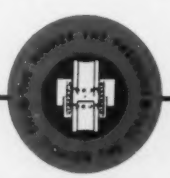


PILOT CYLINDER HYDRAULIC VALVE pressures to 5000 psi. Usually placed close to the work and controlled with an easily operated and conveniently located air valve.



SINGLE PLUNGER AIR VALVE, ⅜" to 1½" sizes. Widely used for controlling single and double acting cylinders and as pilots for other valves

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves



Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated
Mfd. by C. B. HUNT & SON, INC., 1943 East Pershing St., Salem, Ohio

McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Taft-Peirce Mfg Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cee Mfg. Co., 21-25 44th Ave., L. I. C., N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W Canton, Ohio.
Cincinnati Shaper Co. Elam and Garrard Aves Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.

(*Continued on page* 334)

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... make tracks

TO YOUR

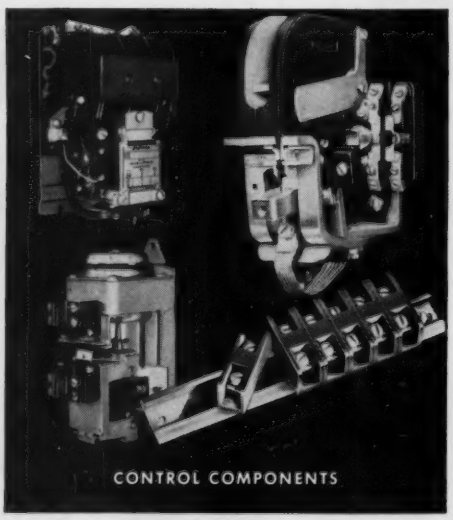
Threadwell

DISTRIBUTOR

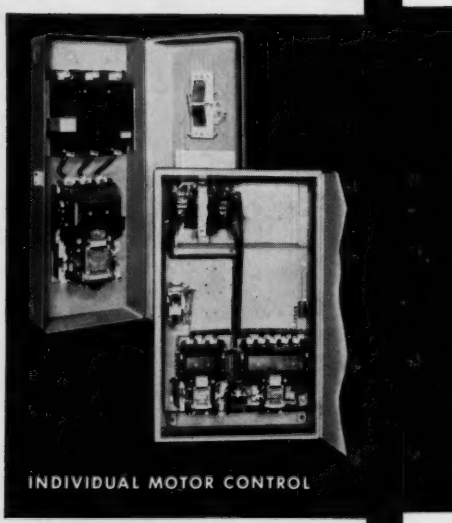
FOR THE FINEST IN
CUTTING TOOLS AND GAGES

Made by THREADWELL, Greenfield, Mass.

MOTOR CONTROL FACTS ON
INDUSTRY'S MOST COMPLETE LINE



CONTROL COMPONENTS



INDIVIDUAL MOTOR CONTROL

FACT:

The only manual reduced voltage starter with air break contacts in all ratings

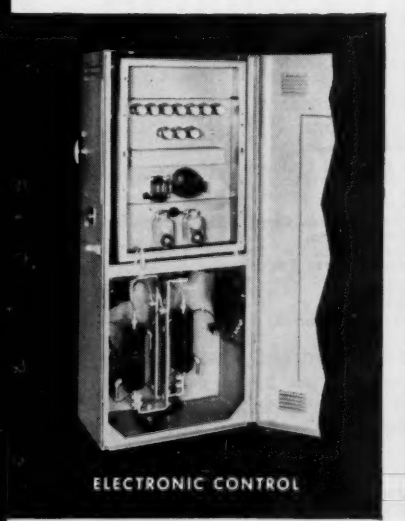
The new Westinghouse Type MB autostarter with air break double contacts eliminates the costly "oil problems" of contamination, oil level checks, spilling and messy leaking. This combined with timed acceleration makes it industry's most advanced reduced voltage starter.

Such product design advances are just part of the total advantages you gain with Westinghouse motor control. *Whatever your control problem* —from the simplest control component to complete automation—it can be solved all from *one* source—*one* responsibility.

For *all* the facts on Westinghouse motor control, call your Westinghouse sales engineer . . . *The Man With The Facts!* J-21872

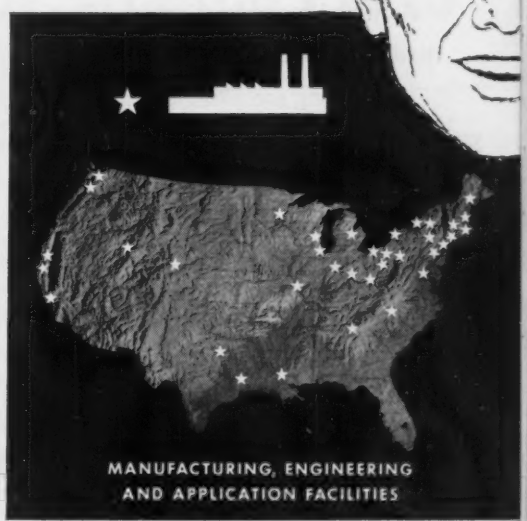
YOU CAN BE SURE... IF IT'S

Westinghouse



ELECTRONIC CONTROL

CONTROL SYSTEMS



MANUFACTURING, ENGINEERING AND APPLICATION FACILITIES

. . . for the finest bearing bronze available from stock

Bunting Bronze Bearings and Bars are made of a special Bronze alloy developed in Bunting metallurgical laboratories through study of innumerable bearing applications and many rigid tests. Known as Bunting No. 72 bearing bronze alloy (SAE 660) this Bronze embodies superlative anti-friction properties together with easy machine-ability and long life.

HE HAS IT

Your Bunting Distributor carries in stock for your money saving convenience completely machined and finished Bunting Standard Stock Industrial Bearings, Electric Motor Bearings and Precision Bronze Bars in a complete range of sizes, meeting all your usual production and maintenance needs. You will find him listed in the classified section of your telephone book—most likely under the heading Bars, Bronze or Bearings, Bronze. Your Bunting Distributor is an industrial distributor or a specialist in certain industrial items. He has been especially selected for his responsibility and his understanding of bearing requirements. Ask him for the Bunting Catalog or write.

Bunting®

BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS
THE BUNTING BRASS AND BRONZE COMPANY
TOLEDO 1, OHIO
BRANCHES IN PRINCIPAL CITIES

Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shearcut Tool Co., Reseda, Cal.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

BUFFERS

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BURS

See Files and Burs, Rotary

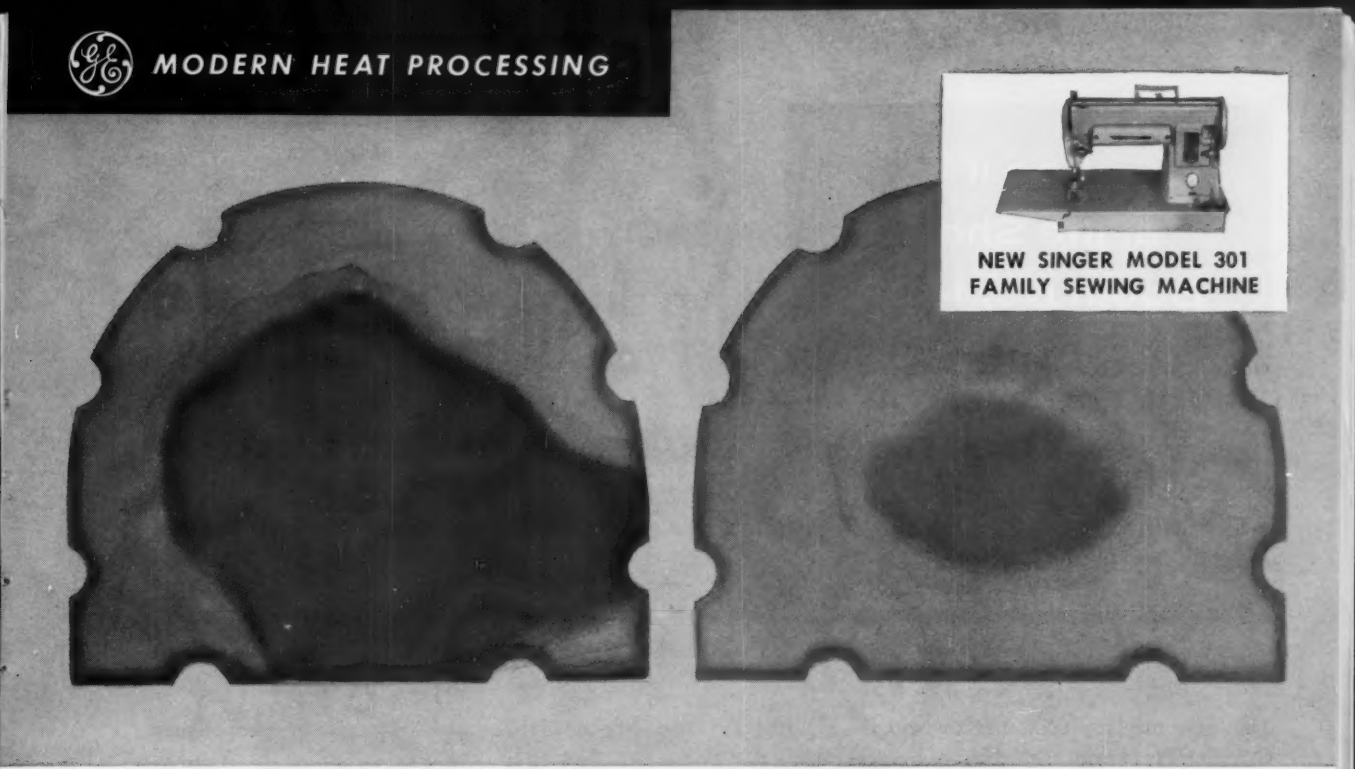
BUSHINGS, Brass, Bronze, Carbide, Etc.

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Unon Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

(*Continued on page* 338)

For more information on products advertised, use Inquiry Card, page 277

MODERN HEAT PROCESSING



OLD METHOD hardened too much of part area, causing warpage. **G-E INDUCTION HEATER** cuts heat-treated area 75%—warpage reduced.

PROBLEM:

Old method of hardening SINGER Sewing Machine parts caused warpage, doubled costs

SOLUTION:

G-E Induction Heater "Pinpoints" Heat Reduces Costly Warping of Treated Parts

The Singer Manufacturing Company, Elizabethport, N. J. was having trouble hardening parts for its sewing machines. Only a small area in the high-carbon steel item needed hardening. But too large an area was being heated with the fuel-fired method used. This resulted in warpage. And subsequent straightening of the part was required. Result—high labor costs and production slowdowns.

A G-E 5-KW INDUCTION HEATER was selected because of its greater selectivity in heating the required area. Now the affected area is "zeroed in" with induction heat. The heated area is reduced 75%, thus greatly reducing the costly warpage. As a result, at least twice as many of these parts per day are being produced with the new 5-kw induction heater for the new SINGER 301 family Sewing Machine.

THE OVER-ALL IMPROVEMENT was explained by the manager of the heat-treating department of The Singer Manufacturing Company: "This method of heating has reduced the area affected by high temperatures to one-quarter of that obtained by the former method. With the G-E induction heater, the warpage is greatly reduced and straightening is no longer a problem. This improvement has produced more uniformly graduated marking on the finished parts and helped us to cut cost."

GENERAL ELECTRIC

G-E 5-KW INDUCTION HEATER

with built-in variable output transformer, handles jobs formerly requiring larger heaters.

For application assistance, contact your nearest G-E Apparatus Sales Office or send coupon for free bulletin GEC-920B.

General Electric Company
Apparatus Sales Division, Section F722-1
Schenectady 5, New York

Name.....

Position.....

Company.....

City.....**State**.....

See it at the Show Booth No. 1402

the Moore-Fosdick

The only machine of its kind in

• Greater range—22″ x 42″ x 27″ height • Automatically positions work to ±.0001″

• Grinds jigs, dies, punches, templates and machine parts • Infinite Grinding Speeds—12,000 to 60,000 rpm • Contour and Chop Grinding • Slot Grinding Attachment • Spindle-Housing Heat Control

This new machine combines the unique Moore Jig Grinding Head with the exclusive Fosdick Automatic Positioning Table. It gives you greater capacity for precision grinding with the speed and convenience of a table that automatically positions work to ± .0001″. *There is no other machine in the world that even approaches the Moore-Fosdick in jig-grinding capacity, versatility, convenience and precision!*

Grinds Cylindrical and Tapered Holes. The Moore-Fosdick allows you to grind cylindrical as well as conical holes, with taper in either direction. An angular and indexing device built into the main spindle, and the newly developed slot grinding attachment, permit the quick, accurate grinding of any contour—*regular* or *irregular.*

Large Work Capacity—Infinite Number of Speeds. The Moore-Fosdick A. P. Jig Grinder has an infinite range of grinding speeds – from 12,000 to 60,000 rpm . . . allowing extreme versatility and accurate control of grinding and stock removal. Larger table size and greater work height, coupled with greater power, *extend* the overall range of precision grinding operations.

SPECIFICATIONS

Capacity:	**No. 30-G**	**No. 42-G & No. 42-PG***
Table size	36″x18″	44″x22″
Table travel, Longitudinal	30″	42″
Table travel, Crosswise	17½″	22″
Table top to wheel collet	2″ to 27″	2″ to 27″
Spindle to column ways	18½″	18½″
Spindle to column below ways	20″	25¼″

Four spindle speeds: 90, 120, 180, 240

Spindle feeds by air-powered hydraulic control—infinite speed control

Grinding speeds: 12,000 to 60,000 rpm; 3 heads

Grinding Capacity:
With grinding wheels, 3/16″ to 5″ (8″ with adapter)
With diamond mandrels 1/64″ to 3/16″

Travel main spindle slide... 3⅛″

Angular adjustment of spindle up to 1½° either way or 3° included angle.

Radial offset of grinding spindle-from center to 1⅛″ off center by rough adjustment-while running 0.0001″ adjustment for distance of 0.075″ anywhere in the 1⅛″ range.

Weights and Floor Space:	**No. 30-G**	**No. 42-G & No. 42-PG**
Machine with regular equipment, including motor	6000 lbs.	11,000 lbs.
Shipping weight	6750 lbs.	12,000 lbs.
Floor space	77″x82″	102″x128″

Standard Equipment:
Four-speed constant torque ¼ hp motor, 220-440 volts, 50-60 cycles, 2-3 phase, wheel dresser—micrometer stop-wrenches. Two built-in locating devices: two 1″ .0001 inside micrometers; two 1″, 2″, 3″, 4″, 5″, 10″ and one 15″ end measurers in box.

Compressed Air Requirements:
90 to 100 lbs. @ 15 cfm, furnished by customer. We recommend a heavy-duty 7.5 hp air compressor with a water aftercooler, provided it is capable of this output.

*42-PG Moore-Fosdick Jig Grinder with Automatic Positioning.

Write today
for price and delivery information.

Jig Grinder

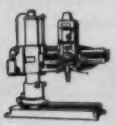
the world!

Grinding Wheel Outfeed, Reads .0001", Adjustable while running
Cross Power Traverse Safety Switch and Positioning Control
Vertical Slide Taper Setting
Positive Adjustable Depth Stop, Micro Setting
Depth Measuring Dial Reads to .001"
Heating Elements for Continuous Temperature Control of Spindle Housing
Grinding Wheel Outfeed Slide, Course Adjustment
Longitudinal Power Traverse Safety Switch and Positioning Control
Measuring Rods or Duplicating Bars
Push Buttons to Control Table and Slide Rapid Traverse and Positioning of Table and Slide
MOORE-FOSDICK

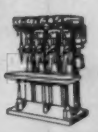
Positions Work Automatically to ± .0001". With the Automatic Positioning Table, you can get fast and accurate positioning of parts to be ground. Two simple duplicating bars may be prepared to position work automatically to ± .0001" – at the touch of a pushbutton. This means that complex grinding jobs with hundreds of holes require only one set-up. On "one-time" jobs, measuring rods can be used in place of bars. For precision production jobs, the easily-made, easily-stored duplicating bars give you a permanent record of positions. Once a job is run, you store the bars and use them every time you rerun that same job – weeks, months or years later.

Grinder Head Dimensional Stability. Latest design of the grinding head incorporates new features to improve further its stability. These include: (1) Electric heating elements in the main spindle housing to maintain uniform temperature whether machine is running or not; (2) An observation thermometer so located as to indicate any temperature change within the housing; (3) The housing itself is cast from 36% nickel iron to reduce the effect of any possible temperature variation to an irreducible minimum.

Need Drilling Equipment? Get a Proposal from Fosdick!


Radial Drills

Jig Borers


Sensitive and Upright Drills

Sensitive Radial Drills

Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

NEW MILLERS FALLS No. 50C ELECTRIC SCREW DRIVER

- TWICE THE DRIVING POWER
- GREATER CAPACITY — wood screws up to #12 x 1½" — machine screws to ¼"
- MUCH LONGER BRUSH LIFE
- BUILT-IN REVERSING SWITCH
- INTERCHANGEABLE SWITCH LEVERS (Paddle or Butterfly)

Plus

the famous, super-sensitive ADJUSTOMATIC® CLUTCH

For years, the Millers Falls No. 50 has been the most successful of all electric screw drivers. Now — in this remarkable new Model 50C — it's even better — more powerful, more versatile than ever before.

In fact, its range of uses is so wide that it entirely supersedes and replaces all four of the previous No. 50 and No. 52 Series screw drivers.

Whether you are assembling delicate eyeglass frames with tiny optical screws or driving 1½" #12 screws in hardwood, you can count on the new 50C for outstanding performance. It's fast, powerful and dependable — and the patented "Adjustomatic" Clutch assures velvet smooth operation with precision torque control month after month.

FREE DEMONSTRATION

Let us show you how the new No. 50C Screw Driver cuts assembly time — gives better, more uniform work at lower cost. Write, too, for literature on the 50C and on Millers Falls wide line of other high-performance electric tools for production and maintenance.

MILLERS FALLS COMPANY
Dept. M-7, Greenfield, Mass.

MILLERS FALLS TOOLS SINCE 1868
The Mark of Superiority

BUSHINGS, Hardened
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS
Ames, B. C., & Co. (Dial) Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starret, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

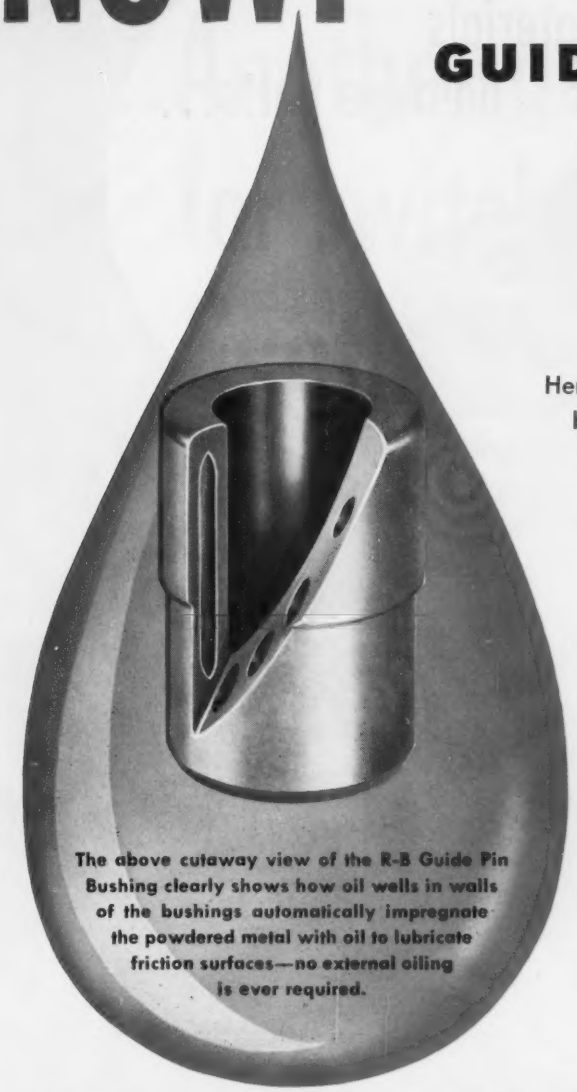
CAMS
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jarvis Corp., Middletown, Conn.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Valenite Metals Corp., Box 205, Royal Oak, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernor Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES
See Furnaces, Heat-Treating
(*Continued on page 342*)

For more information on products advertised, use Inquiry Card, page 277

NOW! Self-Oiling GUIDE PIN BUSHINGS OF POWDERED ALLOY STEEL



The above cutaway view of the R-B Guide Pin Bushing clearly shows how oil wells in walls of the bushings automatically impregnate the powdered metal with oil to lubricate friction surfaces—no external oiling is ever required.

Here's an entirely new concept in guide pin bushings—made of heat treated powdered alloy steel, each bushing has filled internal oil wells. Lubrication to friction surfaces is automatic and no external oiling is required throughout the long life of the bushings.

Wear characteristics of these bushings are comparable to that obtained with finest bronze bushings. In addition, this new R-B design greatly reduces guide pin wear and the possibility of seizing or galling. Self-oiling, less guide pin wear and longer life add up to minimum maintenance, reduced costs and maximum usage of press time.

4117

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 79 • 12619 BURT RD. • DETROIT 23, MICHIGAN

Please send me additional information.

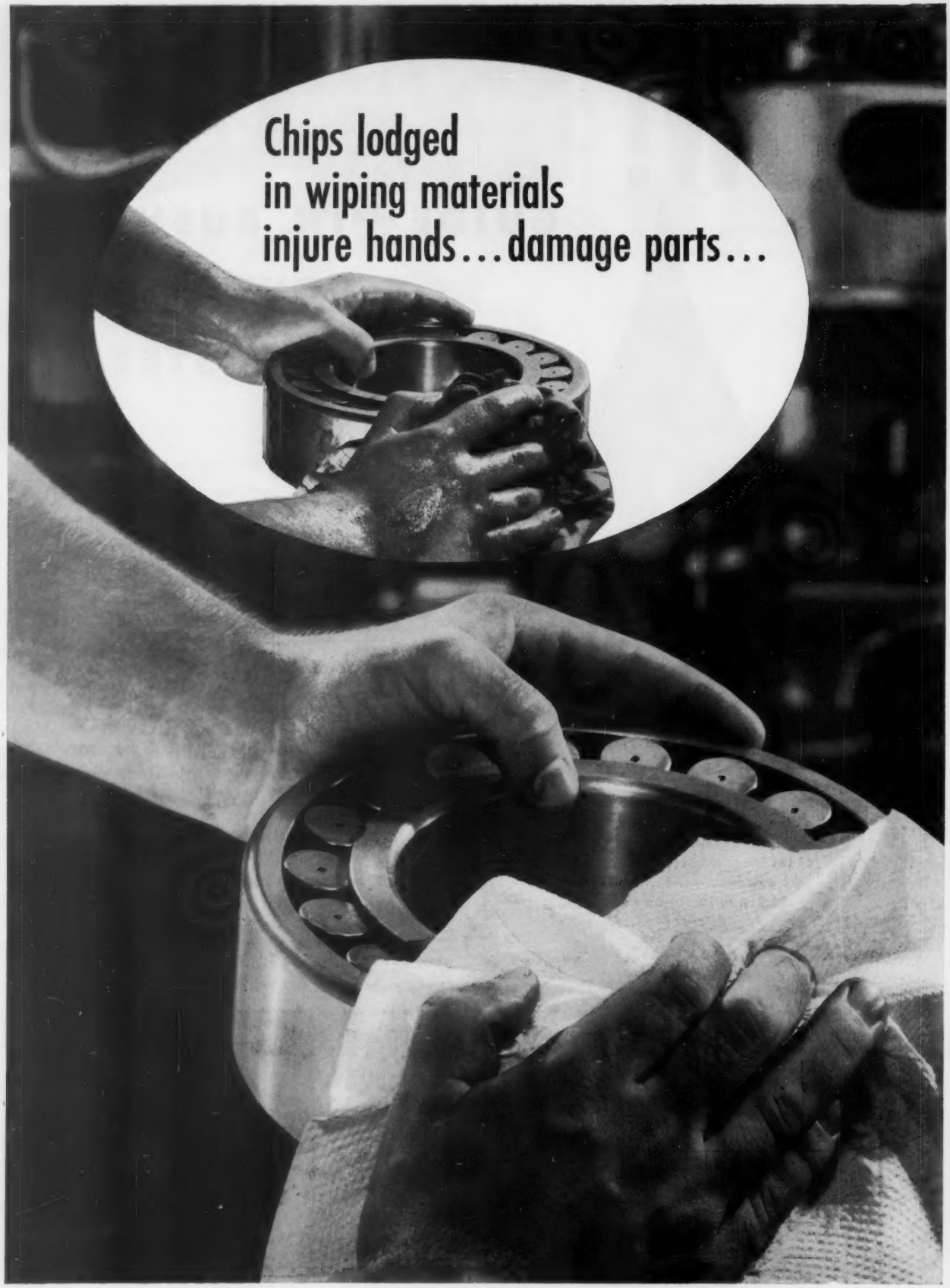
NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Also Produced in
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS


Chips lodged
in wiping materials
injure hands...damage parts...

...Another good reason for switching to **Scott Wipers!**

When a workman reaches for a clean, fresh Scott Wiper—he throws a *used* wiper and harmful chips away.

That means far less chance of injured hands and costly scratches and digs in finished parts.

Because they are available in quantity (125 to the box), a clean Scott Industrial Wiper is always at hand. Distribution and control is a simple matter and lost time waiting for wiping materials is greatly reduced.

Scott Wipers are two-ply and tough yet soft and absorbent. Compare them with whatever wiping material you're using now—for cost, for convenience, for performance.

The Scott representative or distributor in your area will be glad to help you set up a production-line demonstration in your plant. Call him or mail this coupon today.

Scott Paper Company, Dept. M-A, Chester, Pa.

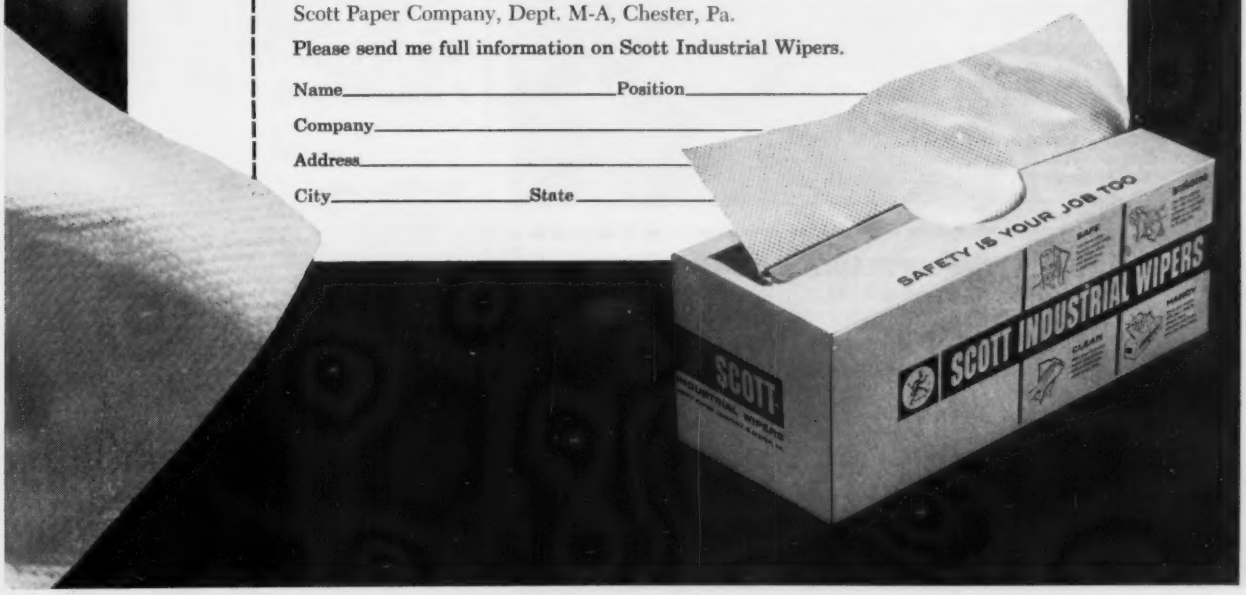
Please send me full information on Scott Industrial Wipers.

Name_____ Position_____

Company_____

Address_____

City_____ State_____



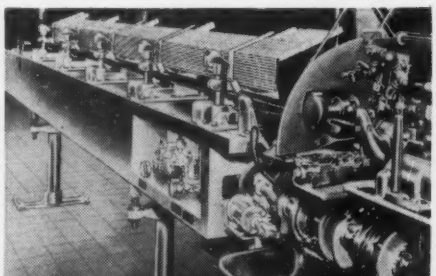
Why let the 4th DIMENSION limit your machine tool output?

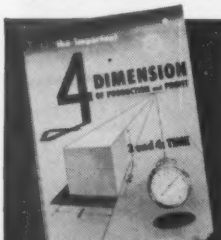
A trip to the washroom or tool crib, a halt for feed finger repair, a spinning empty chuck—these interruptions to the steady flow of production can never be made up . . . for TIME, the 4th Dimension, waits for neither man nor machine.

Over 150 firms have learned how to use every minute of every shift for continuous, 4th Dimension production. Here's how . . .

Lipe A.M.L. Bar Feed Eliminates Time Losses, Increases Output 30% or More

The Lipe Automatic Magazine-Loading Bar Feed is an air-operated attachment which holds an 8-hour supply of bar, rod or tubing and feeds it continuously to any machine equipped with a fixed stop. There are no feed fingers to break down—nothing to scratch or mar polished stock. It will feed any length in one feed-out, thereby cutting cycle time. Remnants are ejected automatically. Idle operation ("cutting air") is eliminated.





Send for this free book. Shows how to convert your machine tools to 4th Dimension Production.

LIPE-ROLLWAY CORPORATION
Syracuse 4, N.Y.

Send me free book on how to gear machine tools to the steady flow of Time.

Name ..... Title .....

Company .....

Street .....

City ..... Zone ..... State .....

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp, Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Dv., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe

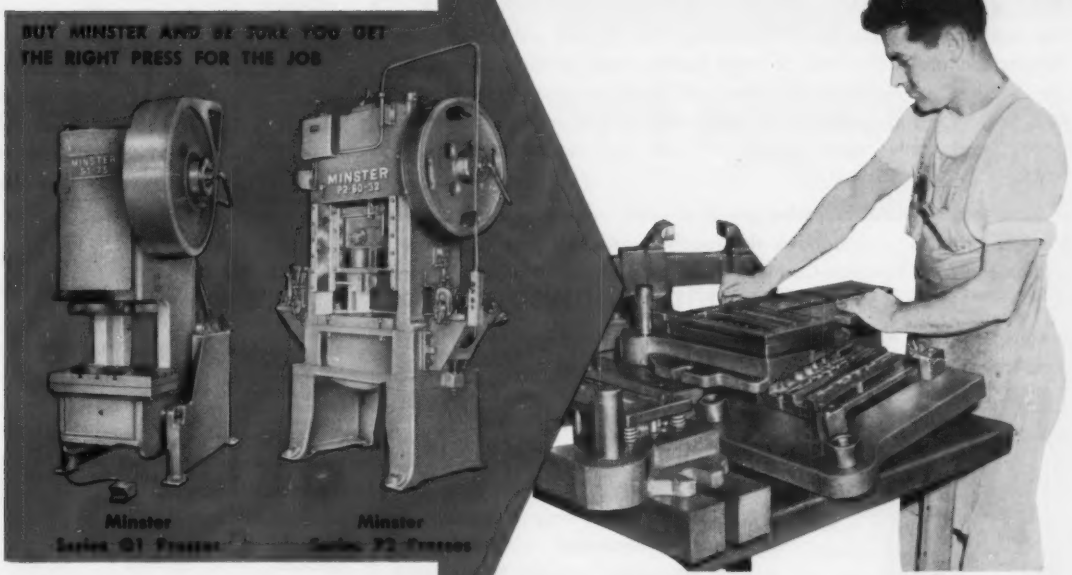
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Dakon Tool & Machine Co., Inc., 1836 Guilford Ave., New Hyde Park, N. Y.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 344)

For more information on products advertised, use Inquiry Card, page 277

A Minster Press means

LESS DIE REPAIR



These Minster Press features *protect* dies from needless expensive repairs.

1. Rugged Minster Frames assure the greatest rigidity with the least possible deflection.

2. Accurate alignment of slide face and bed is assured by Minster Design. Beds scraped to surface plate. Long slide ways scraped square to slide face. Gibs accurately ground and adjusted for proper clearance using ground spacers on all front gibs of presses over 60 tons.

3. Minster bearing bushings honed to proper clearance thus reducing impact shock and snap-thru backlash.

4. Minster patented Combination Air Friction Clutch and Brake has smooth shock absorbing action which tends to reduce die wear caused by impact. Fast controlled engagement or disengagement on 360° surfaces gives opportunity for operator to stop slower presses before dies close in case of misfeed. It also makes possible the use of precision switches in dies to anticipate misfeeds on automatic operations and stop press before serious damage occurs.

Build a sound replacement program modernize with Minster Presses

THE MINSTER MACHINE COMPANY

MINSTER, OHIO

MINSTER®

PRESSES

For more information on products advertised, use Inquiry Card, page 277

Don't "HAND-CUFF" Your Automation Program

Keep Its Tools Sharp and Accurate with

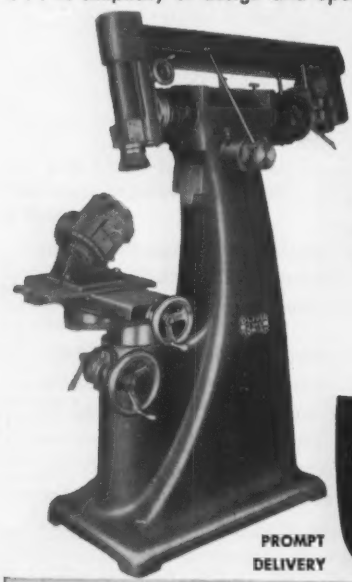
OLIVER ACE

Universal Tool and Cutter Grinders

Among the most important factors in maintaining the efficient production pace set by Automation are sharp and accurate cutting tools which can well be termed the "life-line" of Automation. Cutters and tools, machine ground on an Oliver ACE, assure smooth and efficient operation . . . eliminate production "interruptions" and costly rejects caused by dull and inaccurately ground cutting tools.

The versatile ACE precisely machine grinds a wider variety of cutters than ordinary cutter grinders . . . handles the toughest grinding jobs with ease, including diamond-hard Tungsten-Carbide work and high speed milling cutters and tools.

An economical Oliver ACE in your toolroom will cut time lags to the bone . . . its simplicity of design and operation makes economy of motion and fast grinding certain—only two fixtures required. The ACE is easy to set up . . . needs only a small amount of floor space . . . requires less outlay of dollars.



The efficient ACE is easy to operate . . . requires no computation . . . direct reading for clearances reduces fatigue and eases operators' jobs in grinding the most difficult cutters.

REMEMBER! In order to protect your Automation investment or ANY production schedule—don't neglect the toolroom . . . equip with an Oliver ACE Universal Tool and Cutter Grinder.

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

PROMPT DELIVERY

Priced to meet your budget, the ACE excels for grinding face mills up to 15"—also, slab mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • Fellows helical cutters • reamers • taper reamers • production gashing and carbide tipped circular wood saws.

2 MODELS: Standard and Heavy Duty (illustrated)

Write Today for Complete Data

See our Catalog in Sweet's Directory

OLIVER INSTRUMENT CO.

1410 E. MAUMEE • ADRIAN, MICHIGAN

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

Almond, T. R., Mfg. Co., 4621 Beidler Rd., Willoughby, Ohio
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(*Continued on page 346*)

NOW

a high-speed Quenching Oil that gives all-purpose performance

Here's why metal-working plants everywhere are changing to Shell Voluta Oil 23

1. **High cooling rate through the critical temperature range.** To develop maximum physical properties, various carbon and low alloy steels require higher cooling rates than provided by conventional mineral type quenching oils. Shell Voluta Oil 23, because of its initial cooling rate, helps develop these desired properties in such steels.

2. **Versatility of Use.** Shell Voluta Oil 23, because of its high cooling rate, helps to obtain uniform properties with any steel of variable hardenability. It works equally well at normal (120-150°F) oil temperatures and in hot-quenching operations with oil up to 250°F.

Quenching from cyanide into Shell Voluta Oil 23 gives exceptionally clean part surfaces . . . often eliminates the need for after-quench cleaning.

The cooling rate of Shell Voluta Oil 23 is high through the critical range, while its rate of cooling during martensitic transformation is essentially that of conventional oil. This combination is ideal for minimizing distortion tendencies.

3. **Stability in Service.** Extreme resistance to sludging and viscosity change has been achieved through the careful selection of well-refined base stocks and the use of special additives. Shell Voluta Oil 23 stays the same physically AND retains its high cooling rate. *Write for further details.*

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

CHUCKS, Gear
Gleason Works, 1000 University Ave., Rochester, N. Y.

CHUCKS, Lathes, etc.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Almond, T. R., Mfg. Co., 4621 Beidler Rd., Willoughby, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Prvoidence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg Co., West Hartford, Conn.
Jarvis Corp., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

CLAMPS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.

mail coupon now for free demonstration or literature!

DEKA BORE

offset boring head repeats to

.0001"

in 30 seconds

DEKA-BORE (and only DEKA-BORE) can be adjusted in fractions of 1/10,000" on the full diameter as easily as reading 1/16" on a steel rule. NOT A VERNIER OR SCROLL ADJUSTMENT. Can be calibrated in increments of .00005 on radii or .0001 on diameter as easily as picking up .002 on a conventional micrometer dial.

100% GUARANTEED!

PRECISION TOOL & MFG. CO. OF ILL.
1305 South Laramie Cicero 50, Illinois
Gentlemen: Please send me
☐ Name of nearest DEKA-BORE distributor, who will arrange free demonstration.
☐ Free literature and prices.
NAME _____ TITLE _____
FIRM _____
ADDRESS _____
CITY _____ ZONE ___ STATE ___
M-6

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

CLUTCHES
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS
See Gages, Comparator.

COMPARATORS, Optical
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).

(*Continued on page* 348)

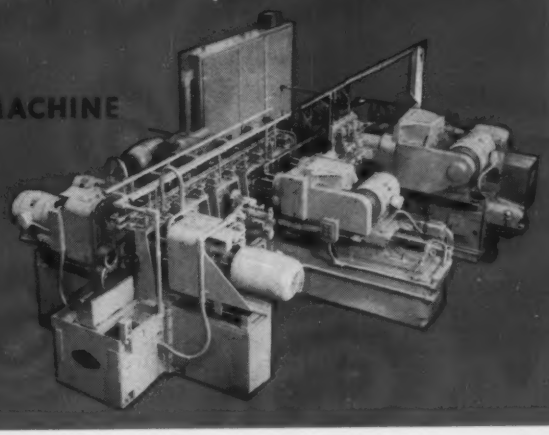
For more information on products advertised, use Inquiry Card, page 277

10 Station Automatic In-Line TRANSFER MACHINE

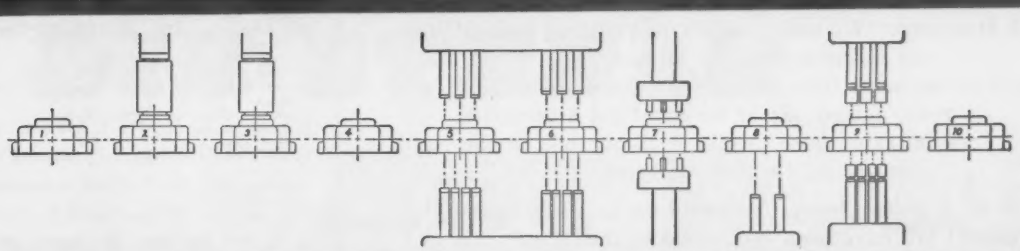
BAKER

Performs Multiple Operations on Tractor Housings

THE MACHINE



THE PART



THE OPERATIONS

STATION NO. 1
LOAD 1 PART

STATION NO. 2
UNIT NO. 1
COMB. SEMI. FIN. BORE 5.165 & 3.249 & 2.861 DIAS.
COMB. SEMI. FIN. BORE 4.425 THRU BOTH WALLS

STATION NO. 3
UNIT NO. 1
COMB. FIN. BORE 5.180 & 3.264 & 2.876 DIAS.
COMB. FIN. BORE 4.440 THRU BOTH WALLS

STATION NO. 4
IDLE

STATION NO. 5
UNIT NO. 2 "U" DRILL 5 HOLES
31/64 DRILL 6 HOLES

UNIT NO. 3 31/64 DRILL 8 HOLES
21/32 DRILL 1 HOLE
"U" DRILL 6 HOLES
23/32 DRILL 1 HOLE

STATION NO. 6
UNIT NO. 2 ½ CHAMFER 5 HOLES
⅝ CHAMFER 6 HOLES

UNIT NO. 3 ⅝ CHAMFER 7 HOLES
13/16 CHAMFER 1 HOLE
½ CHAMFER 6 HOLES
23/32 DRILL 1 HOLE
COMB. COUNTERBORE
.796 & CHAMFER 1 HOLE

STATION NO. 7
INSPECTION

STATION NO. 8
UNIT NO. 4
.6910 REAM 1 HOLE
.8157 COUNTERBORE 1 HOLE

STATION NO. 9
UNIT NO. 5 7/16-14 N.C. TAP 5 HOLES
9/16-12 N.C. TAP 6 HOLES

UNIT NO. 6 7/16-14 N.C. TAP 6 HOLES
9/16-12 N.C. TAP 7 HOLES
½-14 N.P.T. TAP 2 HOLES

STATION NO. 10
UNLOAD 1 PART

Whatever Your Specific Job Problem, Consult Baker Engineers. Write

BAKER BROTHERS, INC., TOLEDO, OHIO

Courtesy of Norton Company

W+B
INDUSTRIAL LUBRICANTS

CHOICE OF THE LEADERS

For 60 Years the top production engineers of the country . . . cost-conscious and production-wise . . . have been coming to W & B saying: "We use a variety of grinding and cutting oils in big quantities. We could cut costs and at the same time reduce our inventory of ready-mixed oils, *if* we could get a versatile concentrated base to mix with our oils in the right proportions for various types of work."

W & B Has Always Delivered for this all-important reason: We have been specialists in the development and application of lubricants for metalworking since 1888.

For example, widely-used W & B Base L, a comparatively light-bodied sulphurized fatty base, is a concentrate used to blend or fortify a wide range of metalworking lubricants for machining, grinding, drawing. W & B Base L mixes quickly and easily with petroleum oils in all proportions to provide efficient metalworking oils at low cost.

Do *you* have a metalworking problem? Ask us, without obligation, to send a W & B Lubrication Expert into your plant to consult with you.

THE WHITE & BAGLEY CO.

Established 1888

Worcester Detroit

Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

COMPOUNDS, Resin and Moulding

General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

COOLANT SEPARATORS

See Separators, Oil or Coolant.

COUNTERBORES

Allen Mfg Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.

(*Continued on page* 352)

For more information on products advertised, use Inquiry Card, page 277

Vanadium-Alloys Steel Company

where the going is

hot and heavy

protect production with our **first quality**

DIE STEELS

for # HOT WORK

Hotform—*5% chromium type.* For die casting dies, dummy blocks, extrusion dies, backer blocks, mandrels, hot piercers, hot forging dies. *Strong, tough, resists heat checking.*

Forge Die—*14% tungsten type.* For forge die inserts, extrusion dies, gripper dies, hot pressing dies, dummy blocks, hot piercing tools. *Resists softening; stable under impact.*

SC Special—*14% tungsten type plus increased carbon.* For hot forging dies and punches, extrusion tools, hot forming rolls.

Marvel—*9.50% tungsten type.* For brass forging dies, extrusion press tools, nut dies and piercers, hot shears, hot swaging dies.

Hotpress—*9.50% Tungsten type* with low chromium for added toughness. For hot press dies, extrusion press tools, upsetter machine dies.

WW Hotwork—*12% tungsten, 12% chromium type* for unusual heat and wear resistance. For brass-casting dies, die casting nozzles, special extrusion dies.

Red Cut Superior—J Temper *18% Tungsten High Speed Die Steel.* For hot press dies for copper and brass, extrusion dies, hot and cold trim dies, punches, heading dies. *High hot hardness and wear resistance.*

VANADIUM-ALLOYS STEEL COMPANY

Manufacturers of First Quality Tool and Die Steels

Latrobe, Pennsylvania

COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL CO.

In Canada:

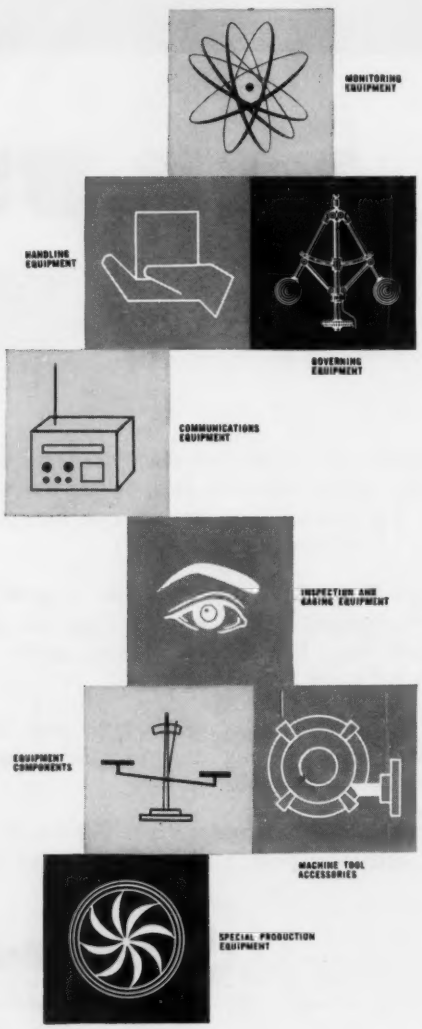
Vanadium-Alloys Steel Canada Limited, London, Ontario

the PRODUCTION ENGINEERING SHOW

SEPTEMBER 6-16, 1955
NAVY PIER, CHICAGO

The Automation Exposition

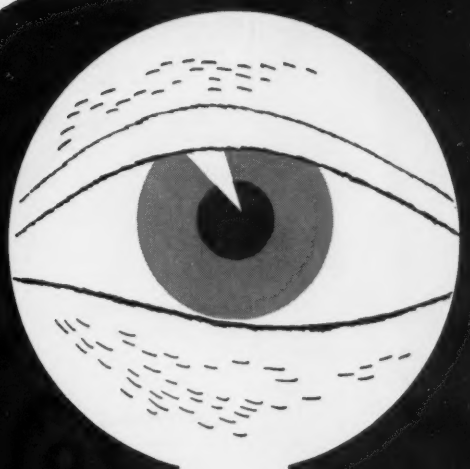
See the devices, instruments, mechanisms and controls of automation you can apply right now!



An exposition that does something about AUTOMATION. Takes it out of the "blue sky" category. Shows you the practical things you can use to make production more automatic. Provides in one place, at one time, a comparison of the devices, instruments and controls to automate prime production equipment. Demonstrates how to integrate and control entire production lines to reduce costs and increase output.

The Production Engineering Show is a fitting companion to the great Machine Tool Show, held simultaneously in Chicago at the International Amphitheatre. See both shows. Your P.E.S. badge will admit you to the Machine Tool Show, too. And your M.T.S. badge will admit you to the Production Engineering Show. Write for tickets to:

Clapp & Poliak, Inc.
Dept. PES-2, 341 Madison Avenue,
New York 17, N. Y.



17,763* manufacturing V.I.P.s on the lookout for better Production!

No need to squint through a keyhole, though. It's no secret that the latest, the fastest, the most ingenious in cost-cutting metalworking methods will be unveiled at the Machine Tool Show, in Chicago, in September.

More than ninety per cent of the country's leading machine tool builders will be on hand; it's the largest and most important show of its kind, the first since 1947.

Plan now to attend; you can't afford to miss it. And here's an added reason—you can see the latest in machine tool accessories at no additional cost. Your Machine Tool Show badge will admit you to the Production Engineering Show, on the Navy Pier, on the same dates.

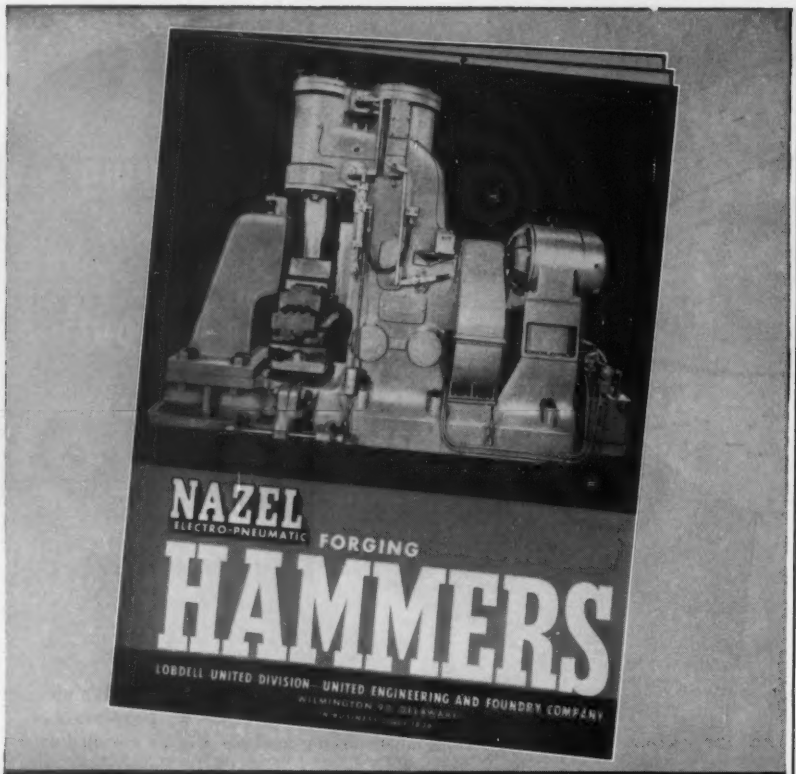
Bring your key production people with you; share with them this unequaled opportunity to see the latest developments in machine tools. The 1955 Machine Tool Show is the best chance you've ever had to see **the world's best investment**—***in action!***

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION
2071 East 102 Street • Cleveland 6, Ohio

THE MACHINE TOOL SHOW

INTERNATIONAL AMPHITHEATRE
CHICAGO, ILL.
September 6-17, 1955

* Estimated Attendance, Before Receiving Your Reservation



NOW! THIS NEW BULLETIN

TELLS ALL ABOUT
NAZEL ELECTRO-PNEUMATIC FORGING HAMMERS

The new, 20 page NAZEL Hammer Catalog gives the reasons why NAZEL is the world's most widely used Electro-Pneumatic Hammer. One of the reasons is because NAZEL Electro-Pneumatic Forging Hammers are *completely self-contained* . . . do *not* require compressors, boiler, piping, nor fuel. Just the "touch of a button" and the NAZEL is ready to operate . . . and a press of the foot-treadle for the lightest to heaviest ram blow.

For every requirement, the various types and models of NAZEL Hammers are on display in this new Hammer Catalog . . . along with specifications and examples of specific installations and applications.

Write, today, for your copy of this new NAZEL Hammer Catalog.

LOBDELL UNITED DIVISION
UNITED ENGINEERING AND FOUNDRY COMPANY
1836 WILMINGTON 99, DELAWARE 1955

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Jarvis Corp., Middletown, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution
Brown & Sharpe Mfg Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES
Starrett, The L. S., Co., Athol, Mass.

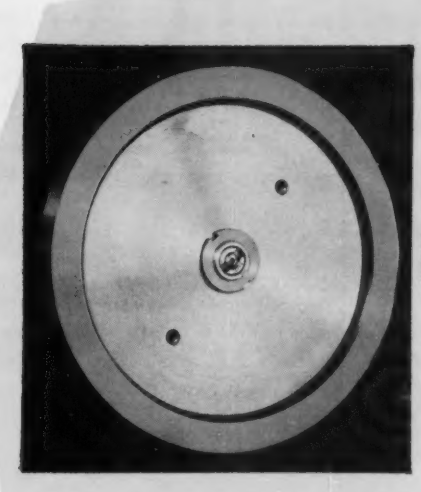
COUPLINGS, Flexible
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.
(*Continued on page* 354)

For more information on products advertised, use Inquiry Card, page 277



100% more pieces per grind
300% less tools required per job
400% savings in monthly tool cost

the superiority of ELOX electrical discharge grinding was proved by this large automotive company's unsolicited 2-month comparison report!**

Tool Name, Description:	Solid Carbide Insert	
Part Name:	Crankshaft	
Operation Name:	Finish Front & Rear Thrust Bearings	
	Standard Grind	Elox EDM Grind
TOTAL PIECES PER TOOL	17,290	95,904
MINUTES PER GRIND	21.0	13.75
COST PER GRIND	$ 1.26	$ .83
ESTIMATED MONTHLY TOOL COST	$294.71	$92.19

in writing Elox will guarantee increased tool productivity over any type of abrasive grinding.

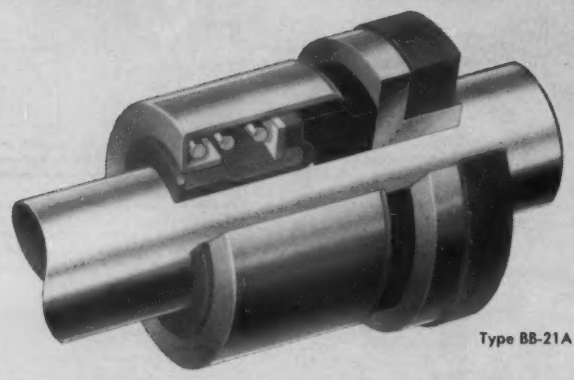
Other Elox equipment available to remove broken taps, drills, etc., from $495 to $3450.

elox *corporation of michigan*

**Comprehensive report and company name given on request.
*T. M. Reg.

742 north rochester road • clawson, michigan

GARLOCK MECHANIPAK SEAL



Type BB-21A

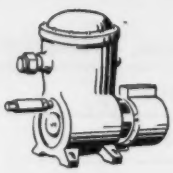
for Rotating Pump Shafts at pressures up to 150 p.s.i.

COMPLETELY ASSEMBLED — READY TO INSTALL

The Garlock BB-21A MECHANIPAK Seal, proven in service on thousands of water pumps, provides a low cost *leakless* seal.

IMPORTANT FEATURES

This MECHANIPAK Seal occupies a very small space—specifically designed for rotary pump shafts. It comes completely assembled, ready to install. Standard construction includes brass shell, brass washer and Buna-N bellows. Other materials available. Furnished for shafts from 3/8" to 3" diameters.



SAVE 3 WAYS

Customers tell us the MECHANIPAK Seal *pays for itself.* (1) Reduces maintenance costs (2) Absolutely no shaft wear (3) Cuts down time.

Get all the facts on this MECHANIPAK Seal. Write today for bulletin AD-150.

THE GARLOCK PACKING COMPANY, PALMYRA, N. Y.

Sales Offices and Warehouses: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Los Angeles, New Orleans, New York City, Palmyra (N.Y.), Philadelphia, Pittsburgh, Portland (Oregon), Salt Lake City, San Francisco, St. Louis, Seattle, Spokane, Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ontario

GARLOCK

PACKINGS, GASKETS, OIL SEALS

MECHANICAL SEALS, RUBBER EXPANSION JOINTS

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread).
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, grinding, Etc.

CUTTING AND GRINDING FLUIDS

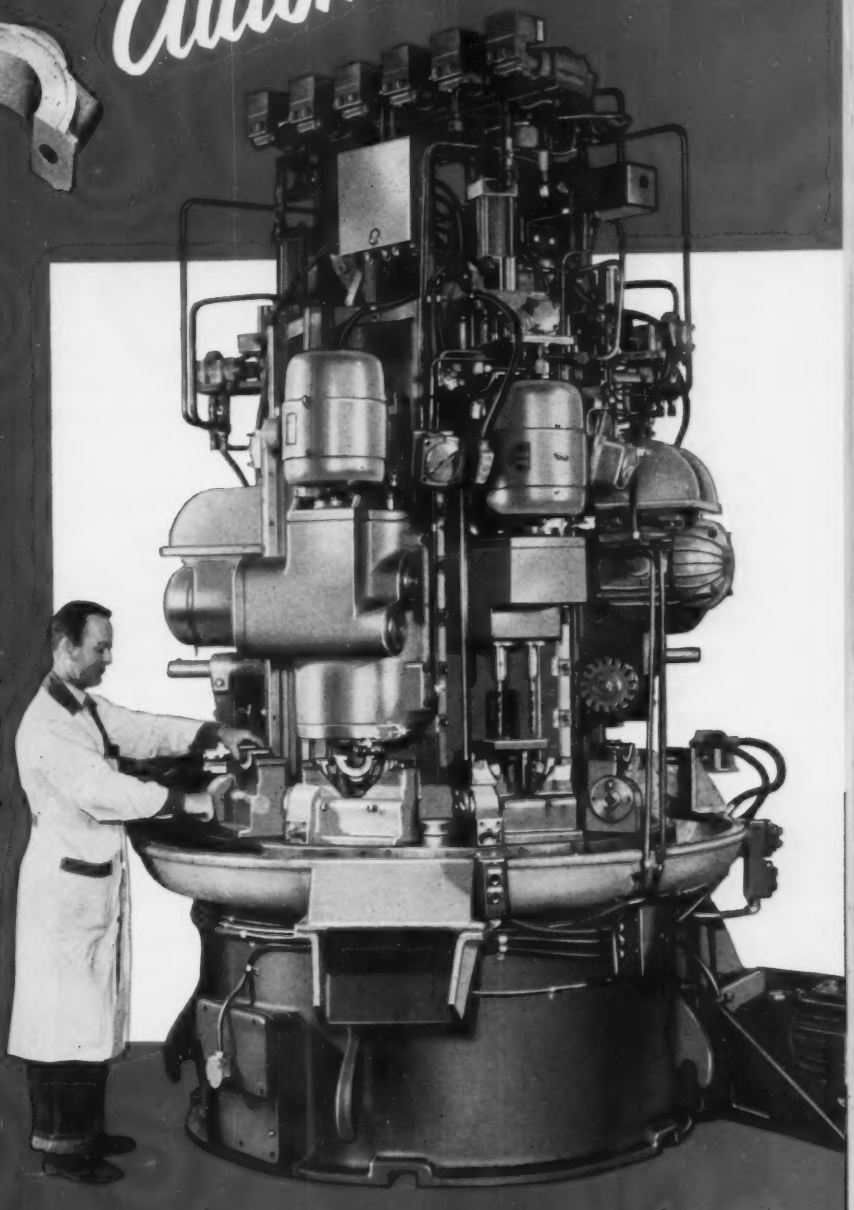
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

(*Continued on page 356*)

For more information on products advertised, use Inquiry Card, page 277

4 separate machining operations on 3 different parts—

Automatically



A special Mercury 8-station center column milling and drilling machine mills joint face, ends, side face and babbit retention notch, and also drills mounting holes. The machine accepts three styles of diesel engine bearing caps, automatically senses and differentiates between the various types, withholding or actuating each head as the work demands. Production rate is 65 pieces per hour at 100% efficiency.

A SYMBOL OF FINE CRAFTSMANSHIP SINCE 1933

MERCURY — *Designers and Builders of Special Machines*

MERCURY
ENGINEERING CORPORATION

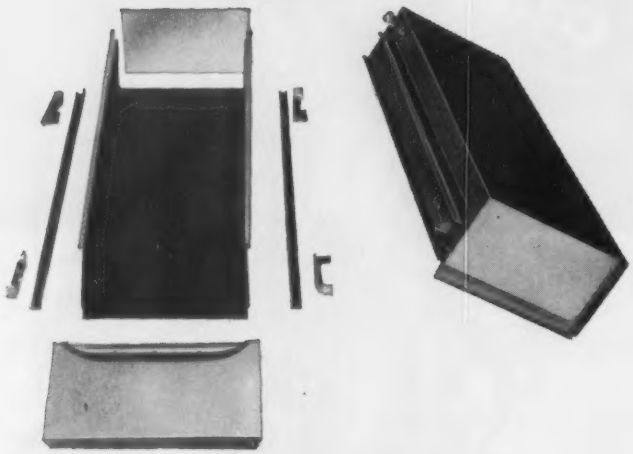
Milwaukee 2, Wisconsin

Your Inquiry Is Invited

HOW Federal® Helps GF

BUILD BETTER METAL OFFICE FURNITURE

SPECIAL WELDER COMPLETES 300
9-PIECE DRAWER ASSEMBLIES PER HOUR



Desk drawer units in the new General Fireproofing Generalaire* line of metal office furniture are assembled and welded on special automatic resistance welder designed and built by Federal.

Nine separate parts are spot and projection welded in this machine to produce a complete drawer assembly. Dual shuttle fixtures are employed permitting maximum utilization of the welder. While one fixture is being loaded and reloaded at one end of the machine, the fixture on the opposite end is in the welding station. With an operator at each fixture loading station, a total hourly production of 300 drawer assemblies can be obtained.

Built-in rapid adjustment that will accommodate four different drawer sizes and "swing out" gun mounts for easy maintenance are two of the many features designed into this machine. It's another reason why Federal **Stays — First in Resistance Welding.**

For further details write for special bulletin TD-22 or contact the Federal representative nearest you.

*TM General Fireproofing

Federal® WELDERS
Warco® PRESSES

The Federal Machine and Welder Company
WARREN, OHIO

Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1 Ohio.
Wallace Tube Co., 1304-08 Diversey Pkwy., Chicago, Ill.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelpha 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

(*Continued on page* 358)

For more information on products advertised, use Inquiry Card, page 277

Bremen Bearings, Inc., uses **SUPERLA** *Soluble Oil to give bearings the clean, cool treatment*

PRECISION NEEDLE BEARINGS are the exclusive product of Bremen Bearings, Inc., Bremen, Indiana. SUPERLA Soluble Oil is used exclusively in all eight of the Company's Cincinnati Centerless Grinders. Plant management experimented with various soluble oils before settling on SUPERLA. They found none could compare with SUPERLA Soluble Oil with respect to wheel loading, stability and tool machine cleanliness.

Plus these benefits, Bremen found SUPERLA mixed readily with water regardless of degree of hardness. The Company found, too, that they got longer tool life and maximum rust protection of work and machines.

You will have the same experience with SUPERLA Soluble Oil. Find out. Inquire of your Standard Oil lubrication specialist. In the Midwest call your nearby Standard Oil office. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Ill.

STANDARD OIL COMPANY (Indiana)

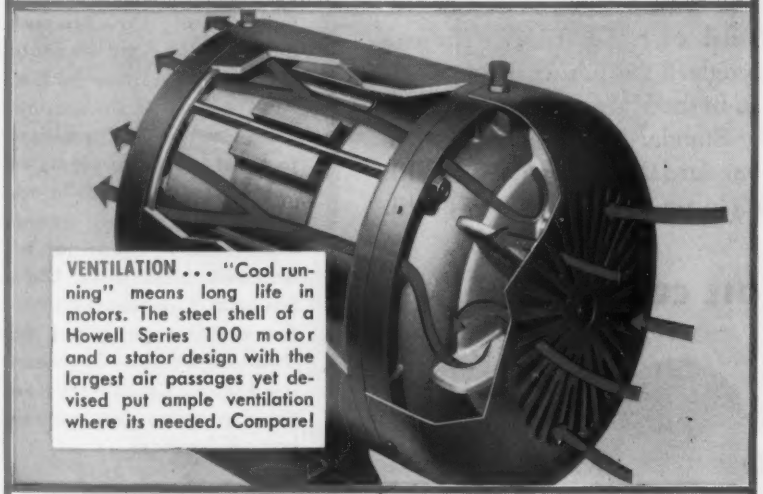
Franklin D. Clark (right), Sales Manager, Bremen Bearings, Inc., and Standard Oil lubrication specialist E. A. Hunt, inspect needle bearing. Gene Hunt is well qualified to assist industrial plants on lubrication problems. In addition to his three years' experience in industrial lubrication sales work, Gene has an M. E. degree from Purdue and has completed the Standard Oil Sales Engineering School. Customers find this experience and training pay off *for them.*

Bearings being ejected from Cincinnati Centerless Grinder at Bremen Bearings, Inc. The Company manufactures needle bearings to customers' specifications in sizes from 1/16 to 1/2 inch with tolerances of .0001" and finishes to 3 micro-inches. SUPERLA Soluble Oil is used on all of the Company's grinders.

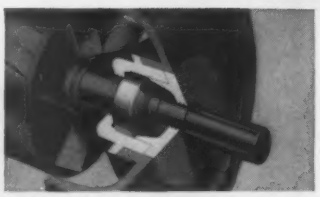
to MACHINE BUILDERS, Howell suggests

What to look for in the new re-rated motors

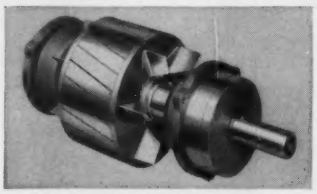
If you've investigated the space and weight saving advantages of the new NEMA re-rated frame sizes, you've observed the variation in the constructions motor manufacturers offer to meet the new standards. The prices may be the same . . . but why not insure that you get the most for your money? Below are some point for comparison . . . and a few of the reasons why the Howell "Series 100" motors are so outstanding!



VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell Series 100 motor and a stator design with the largest air passages yet devised put ample ventilation where its needed. Compare!



BEARINGS They should be fully protected. Dirt can't enter Howell's cartridge-type, double shielded bearings either from inside or outside the motor. On TEFC motors, cartridge remains sealed when end plates are removed. Compare!



ALL-COPPER ROTORS Howell motors have all-copper rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet special requirements. Compare!

The new Howell Series 100 TEFC Motor

SMALLER • LIGHTER • COOLER • MORE STREAMLINED. TEFC and Open Drip-proof types have the same diameter . . . are completely interchangeable.

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(*Continued on page 360*)

Lodge & Shipley T LATHE helps keep 'em flying LONGER

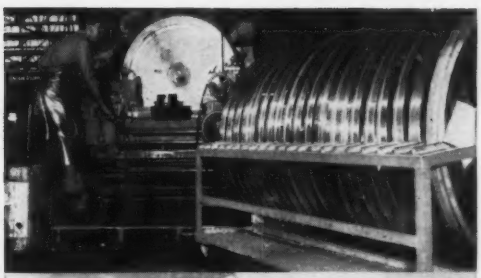
Boeing KC-97 Stratotankers refuel Air Force planes in midair. And, to give the "flying tankcars" extra range, they're now equipped with huge wing tanks designed and built by Ryan Aeronautical Company, San Diego, California.

These tanks are outstanding for light-weight, high strength, and gas-tightness. In their manufacture, a Lodge & Shipley T Lathe plays an important part, machining aluminum bolting rings which join the three sections of each tank.

The alloy rings must be machined flat on mating surfaces to within .002" as they must fit together without more than .004" spacing at any point. This rigid requirement comes from the fact that the rings must prevent fuel leakage even when subjected to extremes in altitude and temperature.

The Lodge & Shipley T Lathe was a natural choice for this job. It has cut machining time on the bolting ring, 40" in diameter and only 2" long, from 1 hour and 15 minutes to 40 minutes, a saving of 46% in time alone.

A Lodge & Shipley T Lathe requires less floor space, less capital investment and gives consistently higher production rates with outstanding precision. For details, request Bulletin 215, The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.



40" diameter aluminum alloy rings are machined to exacting limits on the Lodge & Shipley T Lathe.

Boeing KC-97 Stratotanker wing tanks keep the plane in the air longer. T Lathe-machined rings keep the tanks gas-tight.

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Your Choice

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ON SOUTH BEND LATHES

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Lathe Size	Long Taper Type L Size 00	Cam Lock Type D1 Size 4"
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13" — 1" Collet	38	38
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16", 16-24", 2-H	52	52

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OUR PRICES ARE LOWER
than they were back in 1941
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(*Continued on page 362*)

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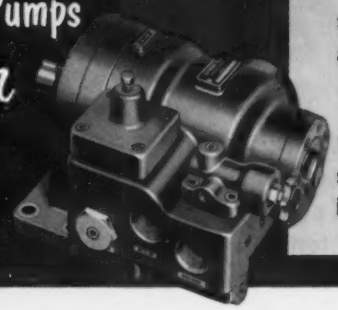
Two-Pressure Oil Hydraulic Pumps Require Less Power for Two-Pressure Circuits



Automatically Provide

High Volume @ Low Pressure for fast closing, rapid advance, and rapid return.

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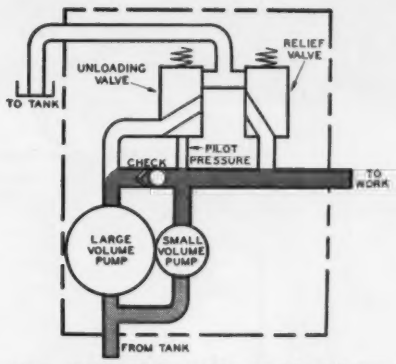

Fig. 1 Combined Delivery of Large and Small Volume Cartridges at Low Pressure

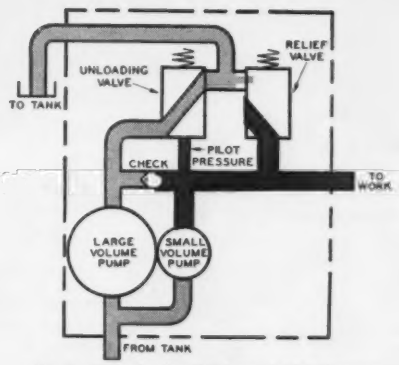

Fig. 2 Delivering Small Volume at High Pressure

Two Vickers Vane Type pumping cartridges are mounted on the same shaft—in the same housing, driven by the same prime mover. One provides a large volume of oil while the other delivers a small volume. These Vickers Two-Pressure Pumps have proved advantageous in a wide variety of applications.

For example, in closing a press or in rapid advance, both pump cartridges work together, supplying maximum volume for quick operation (see Fig. 1). When the press is closed and compression begins, or when the tool goes into feed immediately prior to beginning the cut, the large volume cartridge is automatically unloaded to the reservoir at zero pressure (see Fig. 2). The small volume cartridge alone then provides the lower volume required at high pressure.

These Vickers Two-Pressure Pumps are most economical in power consumption for such two-pressure operation. The reason for this is that a small-volume pump working at full capacity is MORE EFFICIENT than a large-volume pump working at partial capacity. Regardless of momentary delivery, the internal leakage of any pump is proportional to its size and operating pressure. The chart (Fig. 3) shows an interesting comparison between a Vickers Two-Pressure (Two-Volume) Pump and a variable volume vane type pump on a press circuit.

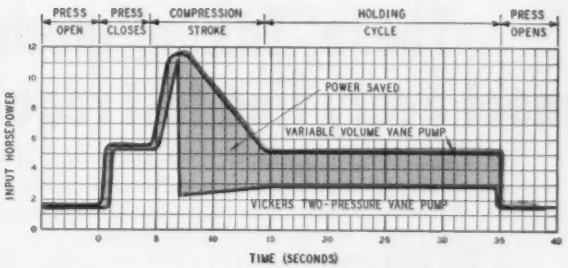

Fig. 3. On this typical press application the saving in power is approximately 50% with a resultant saving in heat in the system.

Like all Vickers Vane Pumps, these two-pressure pumps have the hydraulic balance feature that relieves bearings of all pressure loads (one of the major causes of wear). Cartridge construction enables customer to service in his own plant instead of returning to factory should repairs be necessary. Relief and unloading valves are integral . . . minimizing piping and connections. Complete range of sizes up to 48 gpm. For additional information, ask for Bulletin 54-70a.

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Proper selection of the proper model for your particular requirement depends on the type and thickness of work to be tested, range of loads, purposes for which the machine is to be used—research or control, other hardness testing equipment available and whether a combination of micro and macro hardness testing is required.

We invite you to consult with WILSON engineers on your hardness testing problem. There is no obligation. Write for **Booklet DH-114** *on WILSON "TUKON" Micro Hardness Testers.*

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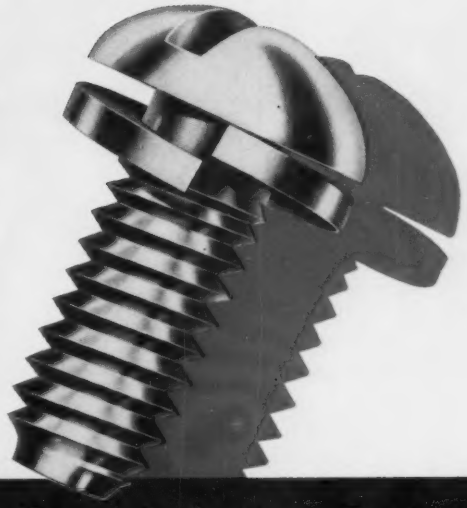
(*Continued on page* 364)

For more information on products advertised, use Inquiry Card, page 277

Send for Engineering Bulletin S-49



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Consolidated Mch. Tool Corp., Rochester, N.Y.
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Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Horiz.

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.

(*Continued on page* 366)

Change cutting tools in 5 seconds!

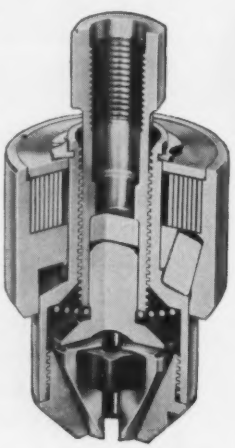
The Jacobs Impact Keyless Chuck designed especially for the aircraft industry makes fast tool changing possible, *and that's not all* —

This chuck has more gripping power than any ¼" chuck in the world.

This chuck *holds* tools in its tremendous grip — there's no slippage, no shank scoring, cutting tools last longer and replacement costs are drastically reduced.

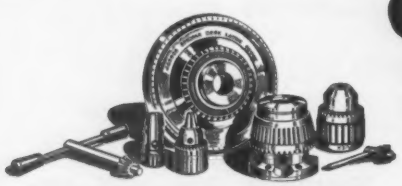
This chuck has no key — to use or to lose.

The performance of the Jacobs Impact Keyless Chuck is another reason why you can continue to look to Jacobs for unquestioned, unequalled and uncompromising quality in the manufacture of hard holding, long lasting precision chucks.



Jacobs Manufacturing Co.
West Hartford 10, Conn.

JACOBS AND YOUR LOCAL DISTRIBUTOR
are ready to deliver the chucks you need and the service you deserve.
first in chucks . . . first in service



Jacobs
CHUCKS
If it's a Jacobs-it holds

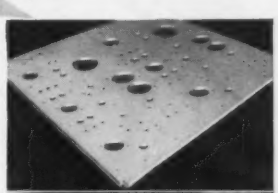
HOW WALES Fabricators produce FASTER and GREATER SAVINGS...

NO OTHER MACHINE LIKE IT!

Rapid interchangeability of punches and dies for various hole diameters plus faster notching and nibbling operations provide the typical astounding time studies described below.

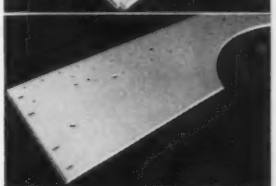
How long would it take you to make similar parts?

Wales Fabricator, the only machine of its kind, permits working direct from blueprints or operation sheets . . . *no templates required.*



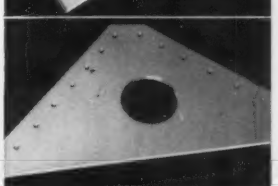
ELECTRONIC CHASSIS 12½" x 11½", with 118 holes and 4 notches was completed including setup in only 32.45 minutes and subsequent pieces in

6.44 minutes.



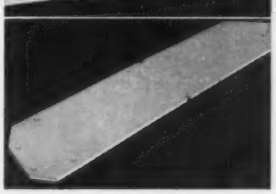
A part of FARM EQUIPMENT, 72½" x 22" with 32 holes and nibbled cut out was finished including setup in only 12.01 minutes, subsequent pieces in

2.32 minutes.



AN AIRCRAFT part 7½"x 4½" with 15 holes and 1 notch was produced including setup in only 3.52 minutes and subsequent pieces in only

54 seconds.



Part of an ELECTRIC REFRIGERATOR, 39⅞ "x 8½" with 10 holes and 4 notches was fabricated including setup in only 5.61 minutes and subsequent pieces in only

37 seconds.

It is too BIG a story to tell here so write today for the complete, fully-illustrated, functionally colored Wales Catalog 10-AA.

WALES-STRIPPIT CORPORATION

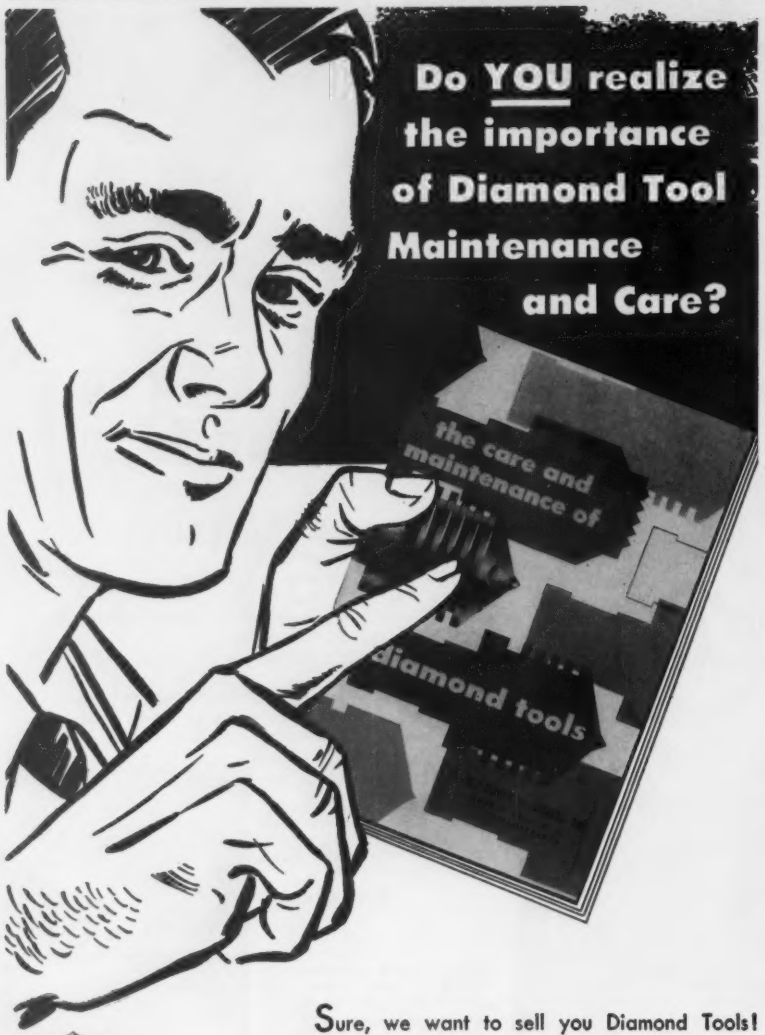
George F. Wales, Chairman

575 Payne Avenue, North Tonawanda, N. Y.

(Between Buffalo and Niagara Falls)

Wales-Strippit of Canada, Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment



Sure, we want to sell you Diamond Tools! However, we also feel there is a definite need of knowledge as to how to take care of the Diamond Tools you already own. That's why we have compiled, edited and printed a booklet which will help you with your diamond tool care and maintenance problems. It's yours for the asking. Merely write for your copy of "The Care and Maintenance of Diamond Tools."

And—when you're again ready to replace wornout tools and if you require engineering advice on industrial diamond products, consult J. K. Smit & Sons . . . We've been in this business since 1888.

Stakoot Model

Cluster Model

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Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
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National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch., Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

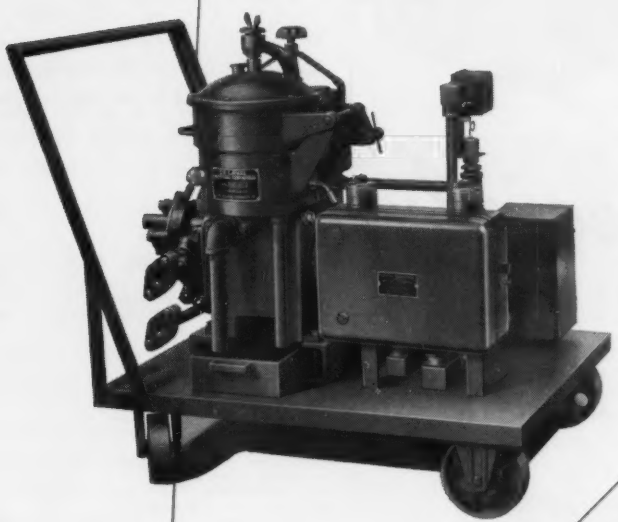
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St. Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page* 368)

For more information on products advertised, use Inquiry Card, page 277

PORTABLE
DE LAVAL PURIFIER
MOVES IN ON LUBE
AND CUTTING OIL PROBLEMS

. . . ANYWHERE!



The De Laval Portable "Uni-Matic"® was designed for plants that must purify small quantities of machine lubricating oil or cutting oil — or both — efficiently and economically . . . at scattered locations.

Individual feed pumps provide variable rates of flow . . . and three-way valve arrangement permits various combinations of operations.

For entire plants . . . or individual departments . . . where oils cannot be easily brought to a single location for purification— the De Laval Portable "Uni-Matic" is the answer.

Write today for full details.

DE LAVAL
purifiers and clarifiers
for factory oils

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 61 Beale St., San Francisco 5

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th nad N. Sts., Richmond, Ind.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS Center

The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 370)

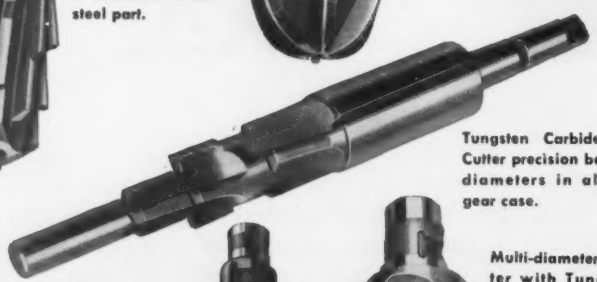
In Defense or Peace

ECLIPSE *Specials*

. . . . ARE THE BEST BUY!

Eclipse Radial Drive High Speed Steel Cutter bores 5 diameters in steel part.

Special Cutter forms ball seat in road building machinery unit.



Tungsten Carbide Tipped Cutter precision bores three diameters in aluminum gear case.

Radial Drive Tungsten Carbide Tipped Cutter bores gear pocket in oil pump.

Multi-diameter cutter with Tungsten Carbide Tipped inserted blades for boring, counterboring and chamfering.

Since 1913—through two wars and during the peace years—Eclipse has met the exacting and changing demands of industry for special purpose end cutting tools. What better test? What better recommendation? Our large modern plant can serve you, too. Send your problem to us, today!

ECLIPSE COUNTERBORE CO.

Founded in 1913

DETROIT 20, MICHIGAN

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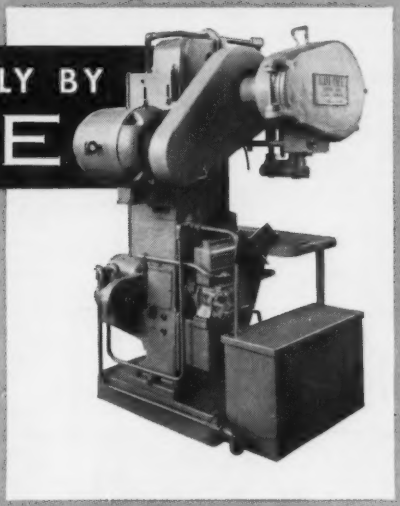
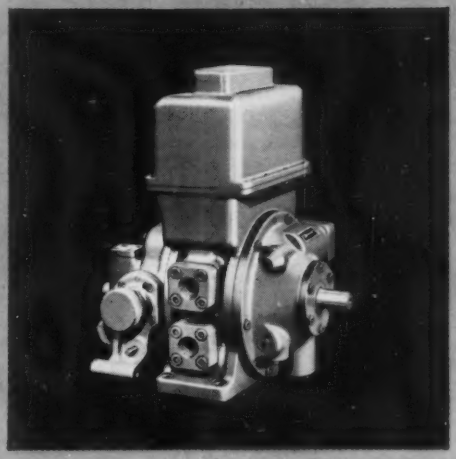
OILGEAR "JK" FEED PUMPS

USED EXTENSIVELY BY MOLINE



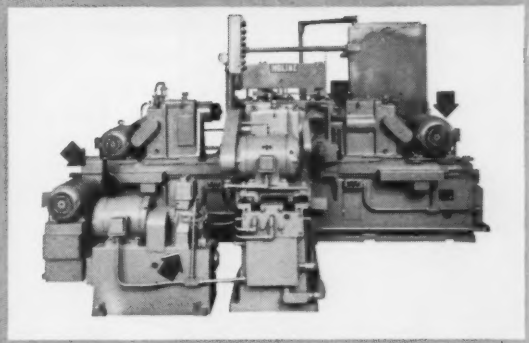


Above, Moline Drilling Machine employing "JK" Feed Pump.

The Moline Tool Company, long established and respected in industry, has used Oilgear Fluid Power Feeds since 1925. Of Oilgear "JK" Fluid Power Feed Pumps used in its machines, Moline says these pumps *combine* the advantages found only in part in various mechanical feeds. Also, the "JK" Feed Pump provides infinitely, steplessly variable speeds; you can easily find the speed best suited to the work or condition of tools. Traverse speed can be as much as 265 times the feed rate. Coarse and fine feed rates are variable over a 20 : 1 range. Cycle time is cut drastically, production increased, costs reduced. Feed rates are maintained accurately despite varying work pressures by a built-in automatic pressure compensator.

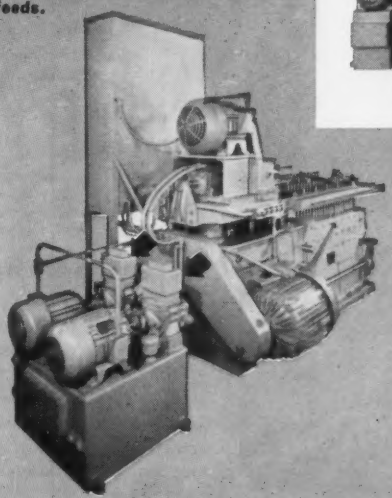
"JK" Feed Pumps are simple, compact, electro-hydraulically controlled units, easily installed nearby or remotely. Systems need only a pump with reservoir, a double-acting cylinder, standard control and two easily connected pipes. Eliminating expensive engineering, these units can simplify design, reduce manufacturing cost, improve performance and increase saleability of machines. Manual, semi-automatic or full automatic operation. Available now in 4 sizes. Write for free literature.

THE OILGEAR COMPANY
1569 West Pierce Street
Milwaukee 4, Wis.

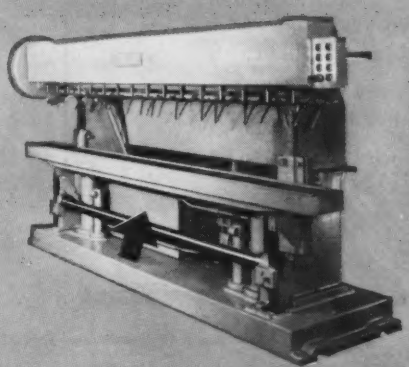


Moline 4-way horizontal boring machine uses 4 Oilgear "JK" Feed Pumps.

Below, Moline special 56-spindle back-spotfacing machine using 2 "JK" units for vertical and horizontal feeds.



Below, Moline ten-foot, straight-line drilling machine using "JK" Feed Pump.



"JK" PUMPS EASILY APPLICABLE TO YOUR MACHINES FOR BETTER PERFORMANCE

JIC

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

OILGEAR
Fluid Power

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

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Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
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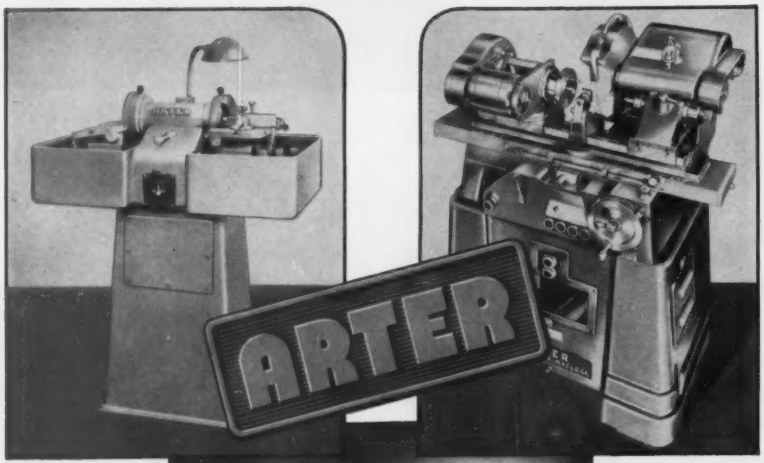
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

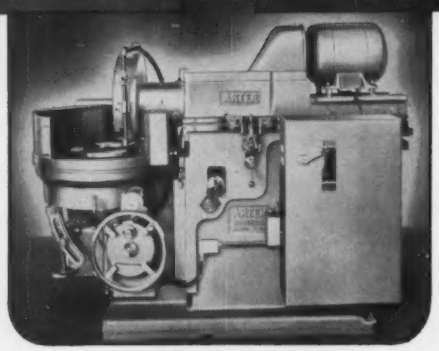
DRILLS, Portable Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLS, Rachet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

The Arter Family of Machines



CARBIDE TOOL GRINDERS



CYLINDRICAL GRINDERS

INTERNAL GRINDERS

ROTARY SURFACE GRINDERS
Chuck Capacity 8" to 40"

The Arter trademark on these machines is the sign of
ACCURACY • POWER • DEPENDABILITY.
Tell our engineers your grinding problems.
They'll find a way to lick them.

ARTER GRINDING MACHINE COMPANY
WORCESTER • MASSACHUSETTS

Agents in industrial centers of United States and Canada

DRILLS, Spade
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

DRILLS, Subland
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.

DRILLS, Twist
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DUST COLLECTORS
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS
Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel

EMERY WHEELS
See Grinding Wheels

END MILLS
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

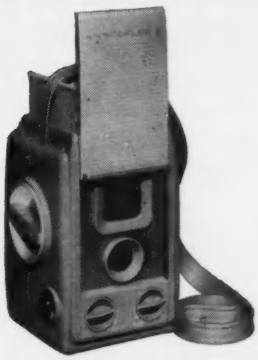
EXTRACTORS, Drill
Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

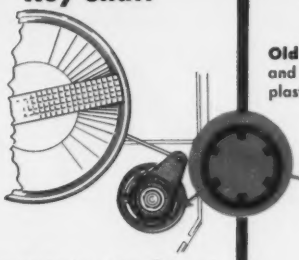
(*Continued on page 372*)

5 Waldes Truarc Rings simplify assembly, eliminate parts, bring big over-all savings to new design low-cost camera

Anscoflex II Camera



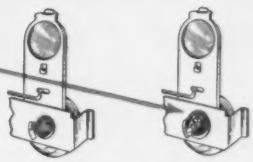
Key Shaft



Parts originally designed for self-locking Truarc ring (series 5105). Some cameras in the past had brass cup staked to the body. At times staking operation cracked the plastic, resulting in loss of expensive part.

Portrait and Filter Lens Knob Assemblies

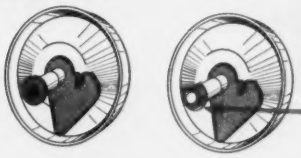
Old way: Knob with plastic shaft used washer and heat forming operation that flattened the plastic pin and locked the pivot in position.



Truarc way: Molded plastic knob with pin is easily and quickly held by a Truarc self-locking ring (series 5105). No groove is necessary. Washer is eliminated and it is possible to remove ring if necessary without damage to knob.

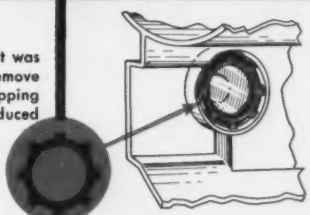
Winding Knob

Old way: With screw and washer design, it was necessary to disassemble entire camera to remove screw which secured winding knob. Self-topping screw sometimes failed to secure knob, produced excessive end play.



Truarc way: Truarc "E" ring (series 5133) allows removal of winding knob without major disassembly of camera, reducing repair time. Use of stacked rings and Truarc applicator saved $10.40 per M on labor. Material saving: $2.29 per M.

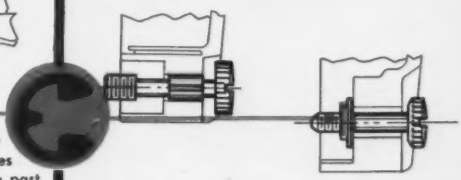
Rear Lens



Parts originally designed for self-locking Truarc ring (series 5005) Some cameras in the past had glass element secured by heat forming tabs from plastic body. Loose or chipped elements resulted in loss of both parts.

Flash-Gun Case Assembly

Old way: In the original design a sleeve was wrapped around neck of screw and pressed into hole of plastic cover. Close working areas made assembly difficult and required extra operation to lock ring into place.



Truarc way: Series 5133 E-Ring snaps onto unthreaded shank of screw quickly, needs no special groove. Labor saving $7.06/M.

Ansco, Binghamton, N. Y., uses the latest technical advances in construction to produce an economical, easy-to-use reflex camera. 5 Waldes Truarc Rings are used in this new design to save material and labor costs, eliminate parts, simplify assembly and reduce rejects.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

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For precision internal grooving and undercutting . . .Waldes Truarc Grooving Tool!

Send for new catalog supplement

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Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
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WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jarvis Corp., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.
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Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
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FIXTURES, Kits For Building
Precision Tool Kits, Inc., 448 Soo Line Lane, Schiller Park, Ill.

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See Couplings, Flexible

FLEXIBLE SHAFT EQUIPMENT
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Pratt & Whitney, West Hartford 1, Conn.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

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Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
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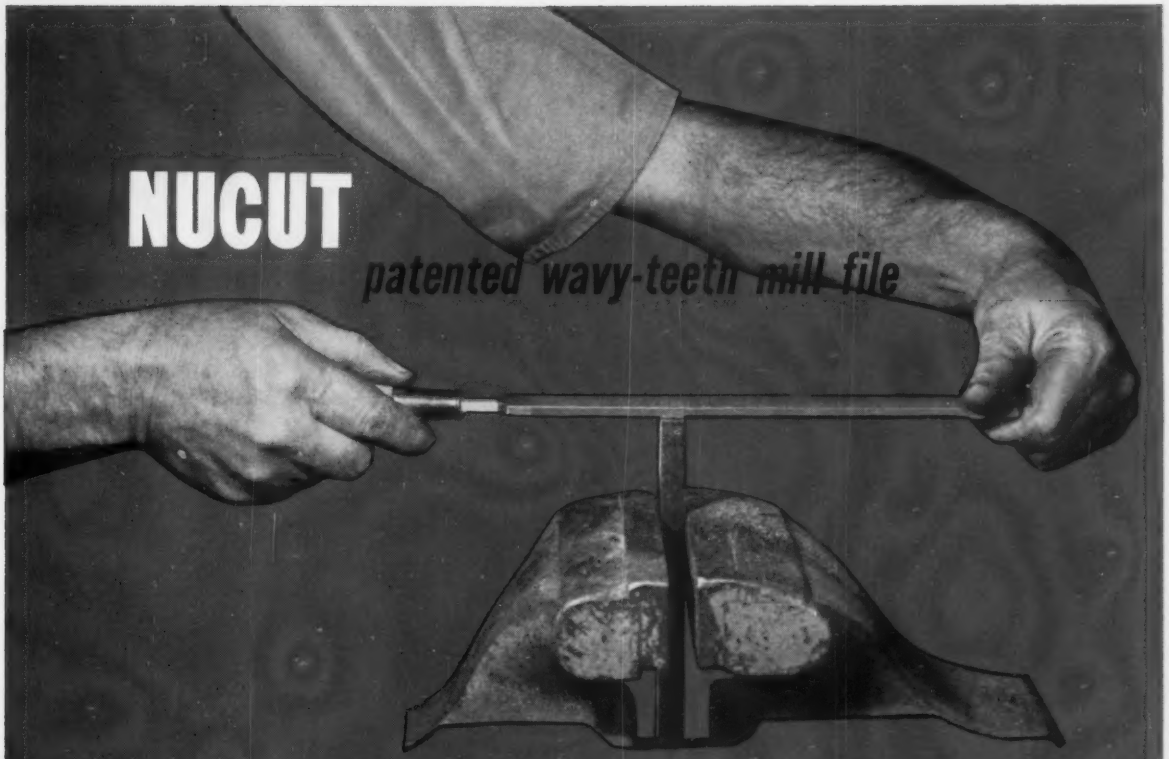
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.

(Continued on page 376)

For more information on products advertised, use Inquiry Card, page 277

NUCUT

patented wavy-teeth mill file



costs no more *than an ordinary file*

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Heller NUCUT files combine coarse, fine and extra fine teeth in a planned irregularity, creating the "wavy-teeth" design. The coarse teeth cut deep, clean; the fine teeth leave a smooth, scratch-free finish. This "Wavy-Teeth" design makes the file clear itself, adds longer life. NUCUT "wavy-teeth" files cut faster without scraping or chattering. Ask your distributor for Heller NUCUT files with patented "wavy-teeth."

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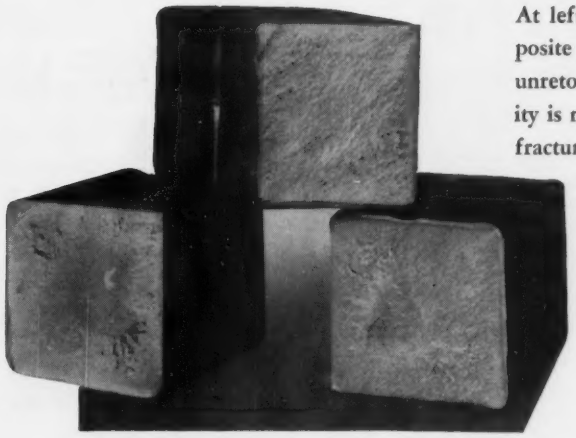
CUTS SIX 10" ROUNDS PER MINUTE, or six 9" squares! That's the kind of speed the "Buffalo" No. 17 Billet Shear can put into your preparation of forging stock! The largest of 11 sizes, to meet a wide variety of requirements.

In all "Buffalo" products is the Q Factor—the built-in Quality which provides trouble-free satisfaction and long life.

LOWER METALWORKING

LOOK INTO "Buffalo" BILLET SHEARS



At left are 9" squares cut by a No. 17 Billet Shear (see opposite page). Note how clean and square the cuts are in this unretouched photo. Note the absence of "smearing"—porosity is not concealed to give you troubles later on. This shear-fracture method is your fastest and most accurate way of dividing billets for forging. High-production speeds range up to 30 strokes per minute on our smallest shear, which handles 2¼" rounds. Rigid, arc-welded steel plate frames, power feed lubrication, overall excellence of engineering make these machines equal to the toughest production runs. Check into these and "Buffalo" Bar Cutters by writing today for *Bulletin 3295-C.*

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Want a machine that will do *all these* jobs *without changing tools?*

1. Punch-slit-miter-shear flat bars
2. Cut-notch-cope-punch angles, tees, channels, I-beams and plates
3. Punch web and flange of channels and I-beams
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6. Cope angle legs (the only machine with independent notcher and coper)
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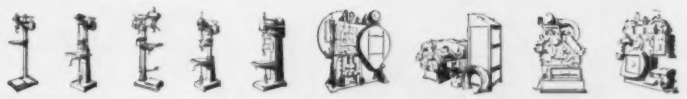

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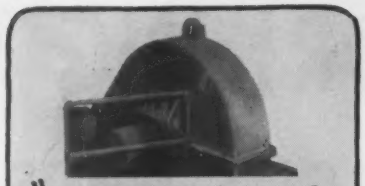

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"The herring-bone gears in the drive unit of our 6-stand, 10-inch mill that rolls our high speed tool steels became noisy. Inspection showed definite signs of flaking of gears. This was in 1939. It was then we started to use LUBRIPLATE in them and we have not encountered any flaking trouble since."

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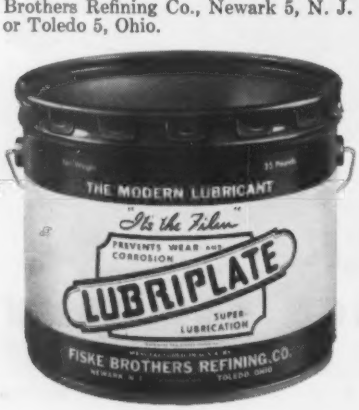

Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
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Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
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Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

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Federal Products Corp., P. O. Box 1027, Providence, R. I.
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Starrett, The L. S., Co., Athol, Mass.
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Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GAGES, Height

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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.

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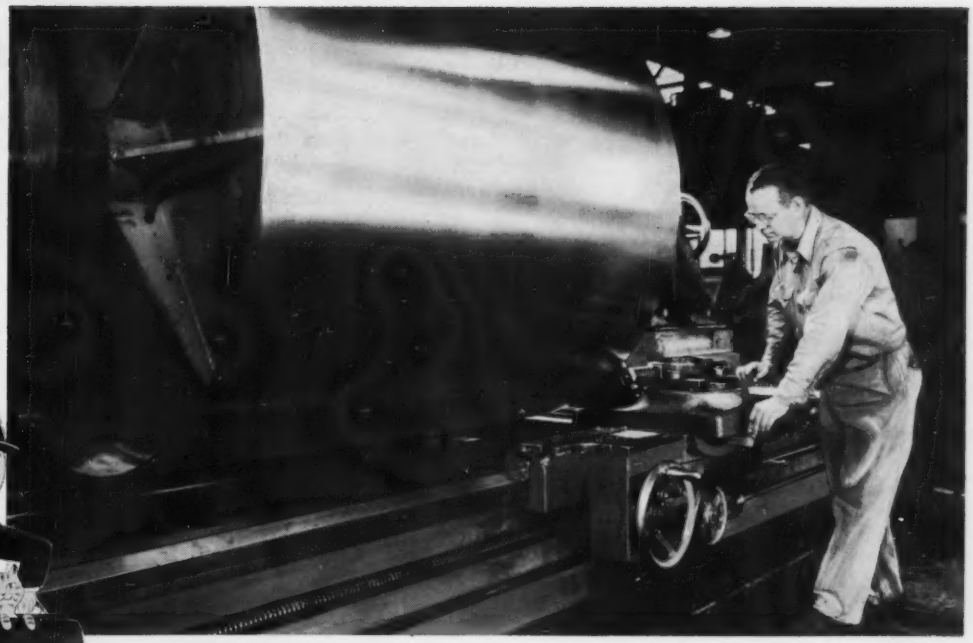
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Elgin National Watch Co., Aurora, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co. Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass

(Continued on page 378)

Photo, courtesy Commercial Machining Company, Conway, Pa. Turning 60" dia. stainless steel looping line roll.



Mr. Tooley Says:

"There's more than one way to skin a cat"

CIRCLE "C"

SUPER HIGH SPEED STEEL

- Operating speeds 25%—50% faster than ordinary high speed steels
- Longer tool life
- Cuts costs by increasing production
- Particularly suitable for cutting tough alloy and stainless steels

FIRTHITE

STANDARD TIPS, TOOLS, INSERTS AND HOLDERS

- Highest metal removal rate
- Uniform, dependable Firthite quality and performance
- Large stocks of standard tools and tips for immediate delivery
- Mechanically-held and brazed designs

Yes, in the field of tooling, alternative cutting materials make it possible to utilize the same production equipment for a variety of applications. In typical turning operations either Firth Sterling High Speed Steel or Firthite Sintered Carbide cutting tools may be selected . . . depending upon the characteristics of the metal and the production requirements of the job.

Firth Sterling, manufacturers of complete shop tooling needs, occupies the unique position of providing *both* steels and carbides to "skin the cat" of production in the most economical and effective ways. Thus, from *one* dependable source of supply you are assured of (1) completely unbiased tooling recommendations and, (2) the selection of the exactly right carbide or steel or *both* to provide maximum production!

Both Firth Sterling's famous CIRCLE "C" Super High Speed Steel and FIRTHITE Sintered Carbide cutting tools and tips are used alternatively for most metal removal operations. Write now for literature and unbiased recommendations for your specific needs.

R-305

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

CALL YOUR FIRTH STERLING DISTRICT OFFICE OR DISTRIBUTOR. ASK MR. TOOLEY.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

A NEW CONCEPT!

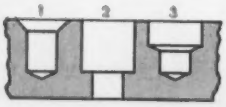
MOHAWK

Size-Optional

SUBLAND

Believing that there is too great a void between standard and special tooling, Mohawk has designed and developed a semi-standard subland tool.

The Mohawk Size-Optional Subland is machined, hardened and placed in a stock bin. This results in a material saving to the customer in set-up costs, reduces delivery time to a fraction of that usually required for special tools, and allows a tremendous reduction in inventory. In ordering these Size-Optional Sublands, the customer is limited only in relation to shank specifications, and partially on overall length requirements. Diameters and step lengths are completely optional to fit the particular application. Write for full details.



SUBLAND DRILL (2-2)
(1) Drill—Chamfer
(2) Drill—Counterbore
(3) Drill—Drill

NORMAL DELIVERY
1 WEEK
FROM RECEIPT OF ORDER

Mohawk
TOOLS, Inc.
819 E. MAIN ST., MONTPELIER, OHIO

worlds largest producer of Sublands

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

(*Continued on page* 380)

NEW

LOW PRICED AUTOMATIC SURFACE GRINDER

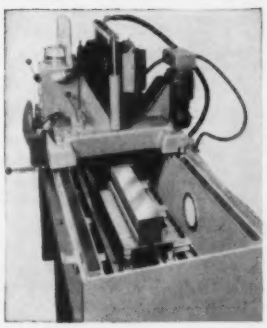
THE *Grindmatic* by LEMPCO

In introducing the Grindmatic, Lempco is actually introducing a new way to make a double reduction in grinding costs.

1. The Grindmatic means a low investment cost . . . *your first savings!*
2. The Grindmatic brings lower production costs . . . *savings that multiply with use.*

The Grindmatic represents the highest value ever offered for your grinding dollar. Designed specifically for industrial grinding applications, it combines fast set up and automatic traverse. Quick feed and positive control of the grinding wheel speeds up operation. Designed for use with conventional holding fixtures or a magnetic chuck offered as optional equipment. Bed arrangement permits inspection for finish and accuracy without removing the work from the machine. This combination of features reduces handling and cuts grinding time per piece.

If obsolete or low production grinding equipment is robbing you of profit, let Lempco demonstrate the savings you can make with this new, low-priced grinder.



AUTOMATIC TRAVERSE

Length of traverse is set by reversible stops located on the ways. Adjusting stops for desired travel is accomplished quickly and easily. Once the stops are in position, traverse is automatic. Workhead is driven by a separate motor at a constant 45" per minute.

Vertical spindle grinding wheel is counterbalanced by pneumatic cylinders which permits effortless movement. Coolant is supplied from a 50 gallon tank located in the bed of the machine. All controls are grouped for convenient operation.

SPECIFICATIONS:

- Grinding Wheel Speed — 1140 RPM
- Wheel Diameter — 12"
- Work Capacity — 38" long, 11½" wide, max. height 11"
- Bed dimensions — 71" long x 20" wide
- Overall height 63", depth 39", length 74"
- Wheel Motor — 3 h.p.
- Feed Motor — ½ h.p.

LEMPCO INDUSTRIAL, INC.

BEDFORD, OHIO

For 35 Years - a Leading Builder of Machine Tools

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

CIRCOLOY
Saws
Circoloy Saws do jobs too tough for HSS, not tough enough for carbide — let you restrict use of carbide and HSS to purposes they serve best. With longer life, longer production runs, superior cutting they outperform HSS by a wide margin. Recommended both for increased regular production and particularly for automation, where sustained precision performance is indispensable.
For the Best in Circular Metal-cutting Tools
Consult CIRCLE R Specialists in—
BURBANK INDIANAPOLIS PHOENIX
CHICAGO KANSAS CITY PITTSBURGH
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DETROIT PHILADELPHIA ST. LOUIS
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1923 - 1955
PROVIDENCE 5, RHODE ISLAND
METAL SLITTING SAWS
COPPER SLITTING SAWS
SCREW SLOTTING SAWS
COMMUTATOR SLOTTING SAWS
JEWELERS SLOTTING SAWS
CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS
COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 13, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Westinghouse Electric Corp., E. Pittsburgh, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

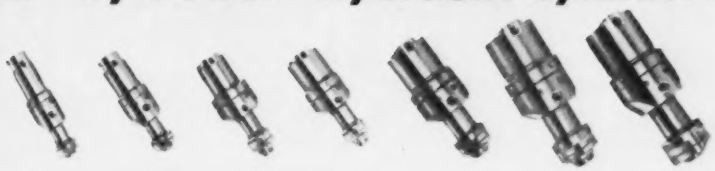
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.

(*Continued on page* 382)

For more information on products advertised, use Inquiry Card, page 277

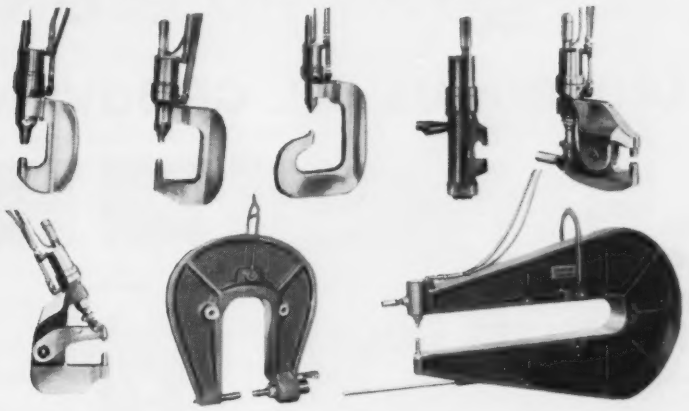
how leading car, truck and trailer builders solve production riveting problems with Hannifin "HY-POWER" Hydraulics

1 They select the correct size "Hy-Power" Hydraulic Cylinders



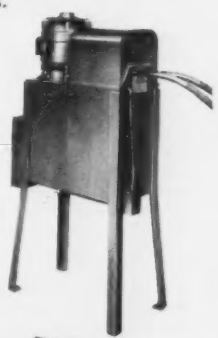
Hannifin supplies "Hy-Power" Hydraulic Cylinders in 7½ to 100-ton capacities (more in multiple) to exert the force exactly when and where you want it.

2 They mount the cylinders in Hannifin "C"-Frames



The "Hy-Power" line includes standard "C"-frames in a wide variety of sizes and types for portable or stationary use. Or, if your requirements are special, Hannifin will design and build "C"-frames to suit your needs.

3 Power source is the exclusive "Hy-Power" Pressure Generator



Here's Hannifin's patented, noiseless pressure generator. It's a compact unit that combines motor, pump, oil reservoir, control valves and high-pressure intensifier.

HANNIFIN "HY-POWER" RIVETING IS THE LONG-TIME STANDARD OF THE AUTOMOTIVE INDUSTRY

If you're looking for a better riveting method—whether you need one riveter or fifty—discuss it with your Hannifin representative. Meanwhile, get the full story by writing for Bulletin 150.

HANNIFIN

Hannifin Corporation, 509 S. Wolf Rd., Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St. Racine, Wis.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

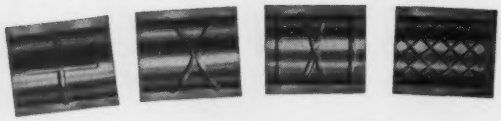
See Grinding Mches, Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

High Speed

CONTINUOUS OIL GROOVING



500

PIECES PER HOUR!

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

The operator loads and unloads the work **without stopping the Machine**—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8", grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4 1/2" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

WICACO

SINCE 1868

THE WICACO MACHINE CORPORATION

WAYNE JUNCTION PHILADELPHIA 44, PA.

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivette Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

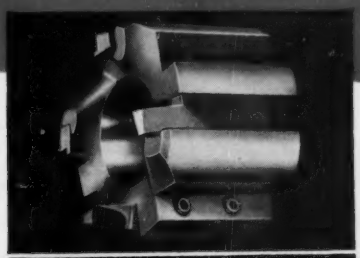
(*Continued on page* 384)

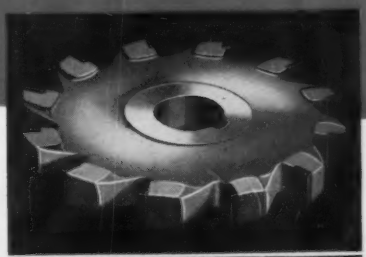
For more information on products advertised, use Inquiry Card, page 277

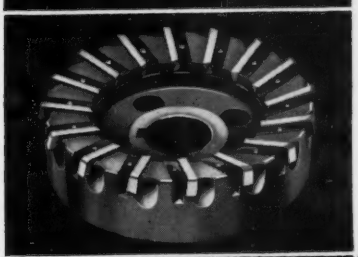
NEW! NEW! NEW!

SUPER TOOL STANDARD MILLING CUTTERS NOW IN STOCK WITH CARBOLOY® GRADE 370

(For your steel-cutting applications)

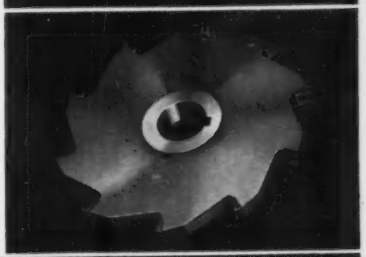


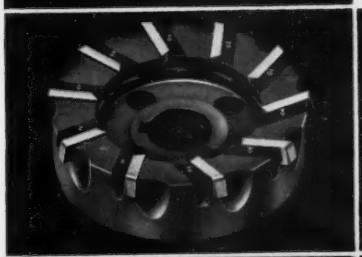


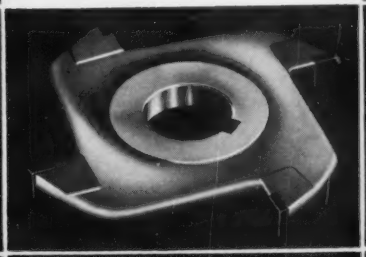


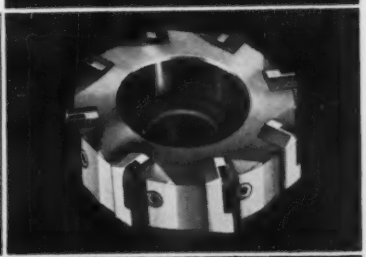
Super Tool's Standard Milling Cutters are now available for immediate delivery with Carboloy Grade 370. This new series of steel-cutting carbide *cuts faster, lasts longer*—operates efficiently at extremely high temperatures as proved by hundreds of actual production tests.

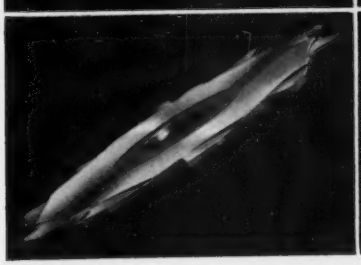
Write now for catalog No. 55, describing the complete line of Super Carbide Tools.

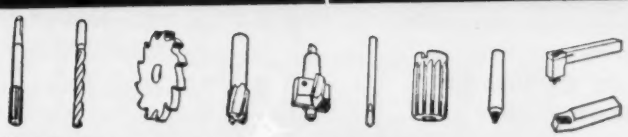












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WAREHOUSES: CHICAGO • DETROIT • NEW YORK • LOS ANGELES

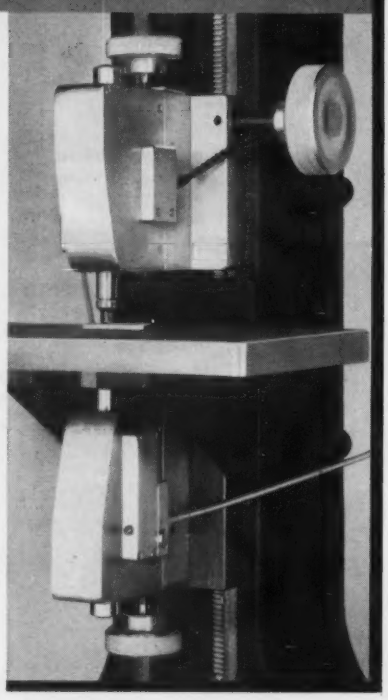
Super TOOL COMPANY

For more information on products advertised, use Inquiry Card, page 277

NEW! For checking gage blocks in millionths — or half-millionths

OPPOSED-HEAD MICRO-AC

Electronic Microcomparator



Unique Caliper Action Assures Positive Gaging. Upper gage head contacts the work in the usual way—while tip of inverted lower gage head extends through hole in table to contact underside of work. Thus the two gage heads provide *direct calipering* of the work. There's no "wringing" of the work to an anvil—no chance for error.

Two Sensitivities are provided, and are used interchangeably at will—with readings of .000010"/.000001" or .000001"/.0000005" per scale division, as ordered.

Repeat Readings within one quarter-millionth are consistently obtained, due to *frictionless gage head movement* and *drift-free amplifier.*

Free Bulletin 552 gives details. May we send you a copy?

OTHER CLEVELAND GAGING EQUIPMENT includes the versatile INDI-AC Electronic Indicator; PAR-AC Electronic Production Gage; AUTO-SORT Electronic Gaging and Sorting Unit. We invite your inquiries.

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Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

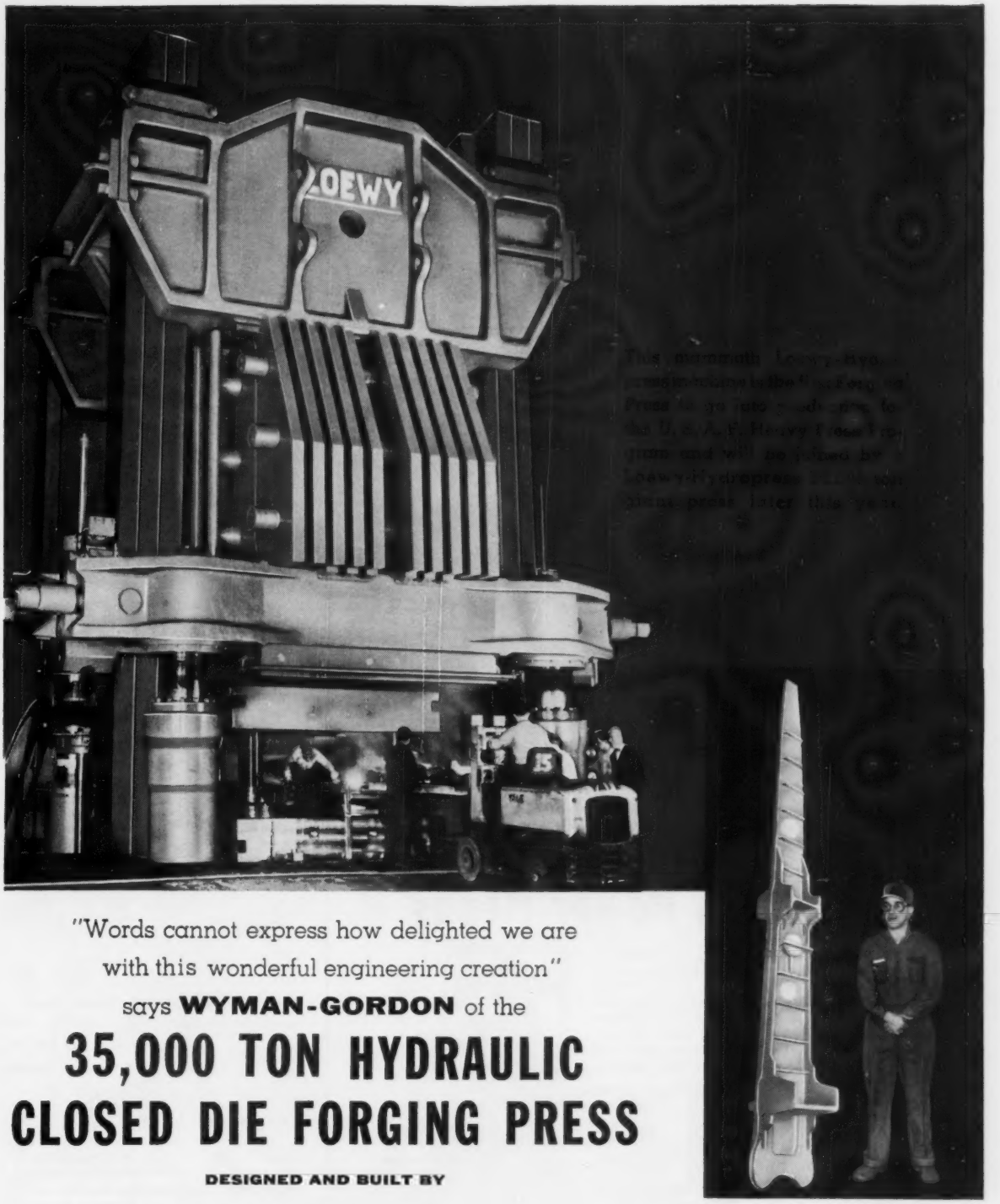
GRINDING MACHINES, Face

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

(*Continued on page* 386)



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Forged Aluminum Wing Spar for Supersonic Aircraft.
This one-piece forging replaces conventional assembly of 272 parts, 3,200 rivets, and saves 100 lbs. of metal plus substantial man hours.

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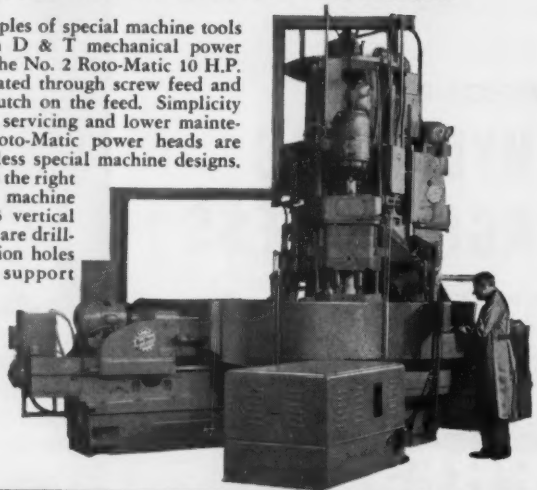
GRINDING MACHINES, Gap
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth
See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

Use D&T Machines With New Mechanical Power Heads

Here are two good examples of special machine tools designed and built with D & T mechanical power heads. Shown above, is the No. 2 Roto-Matic 10 H.P. head. All sizes are operated through screw feed and have overload release clutch on the feed. Simplicity of design makes for less servicing and lower maintenance costs. D & T Roto-Matic power heads are readily adapted to countless special machine designs. For instance: Machine to the right is a 6 station indexing machine with 3 horizontal and 3 vertical power heads. Operations are drilling and reaming suspension holes and king pin holes in support arms for power heads.



Free Data

is available on the complete line of D & T machines. Ask for Bulletin 1000.

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig
Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

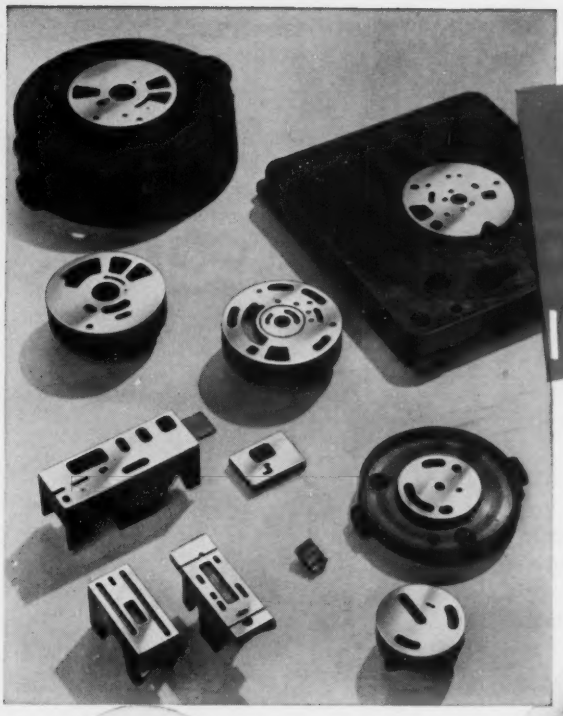
GRINDING MACHINES, Piston Ring
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GRINDING MACHINES, Ring Wheel Ball Race, Etc.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

(*Continued on page* 390)

For more information on products advertised, use Inquiry Card, page 277



Get Precision Flatness, Finish and Parallelity on Valve Parts Like These . . . In Production Quantities With a

Lapmaster®

Air brake valve parts like these are being production lapped on JOHN CRANE Lapmasters every day at a tremendous savings in time and money. For instance, one of the rotary valve seats shown here formerly required over two hours of lapping time to pass the "no leak" bubble test — time has now been cut to ten minutes on the Lapmaster.

This is the machine for you if you are looking for precision flatness and finish in quantity on all forms of ferrous and non-ferrous metal, ceramics, plastics or crystals. Lapmasters readily lap to the extremely close tolerance of one light band (.000011") or less. They also produce a fine finish to as low as 1 RMS.

You are invited to send us a few sample parts including surface finish specifications and approximate production requirements. Our lapping laboratory will then be in a position to provide you with complete facts on the application of the Lapmaster to your work. There is no obligation.

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Agitator tank keeps abrasive and vehicle in proper suspension
Solenoid valve controls correct flow of abrasive
Abrasive mixture flows down feed track
Mixture is evenly distributed over lap plate by rotating conditioning rings
Spent mixture drains off through serrations in lap plate
Conditioning rings serve as standard workholder
Conditioning rings keep lap plate flat automatically

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FREE TECHNICAL DATA
on the Lapmaster is available on request, also information on measuring flatness. Write for your copies today.

Lapmaster® DIVISION

CRANE PACKING COMPANY

38 YEARS INDUSTRIAL PROGRESS

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uninterrupted stamping production

More finished stampings per shift at lower cost is the final test of a new press line . . . to meet this test, production men concentrate on fast, *uninterrupted* production from one end of the line to the other. Every press is a vital station, every operation is critical in keeping the line running as a mass production unit.

That's why you find more and more new stamping lines made up completely of Danly Presses. You will find many reasons. Danly Presses are known for their extra rugged construction to withstand the stresses of continuous operation at full capacity; exclusive control arrangements facilitate automation; maintenance needs are decreased by automatic *oil* lubrication.

There's a great deal more to the Danly Press story, too — design and construction features that will make Danly Presses a must on your new line. Call a Danly engineer for a detailed discussion now.

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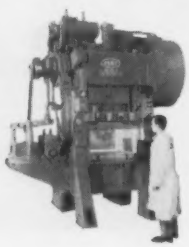
DANLY

specify:

complete lines of NEW DANLY PRESSES

It costs less to run a DANLY PRESS line!

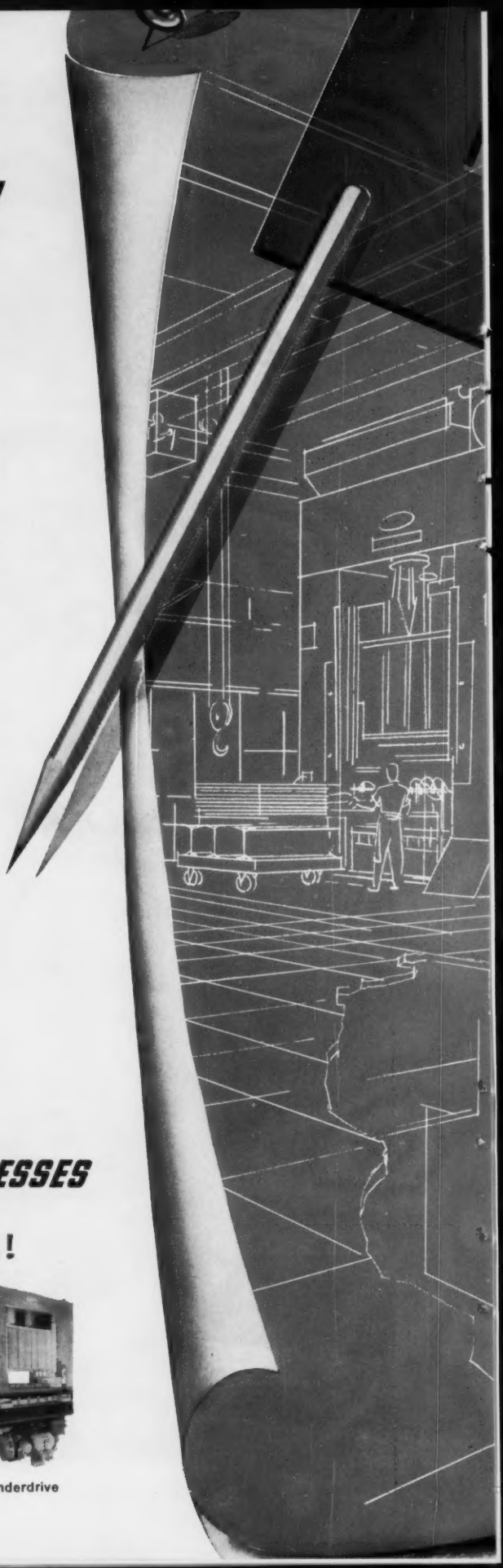
Single Action
Straight Side

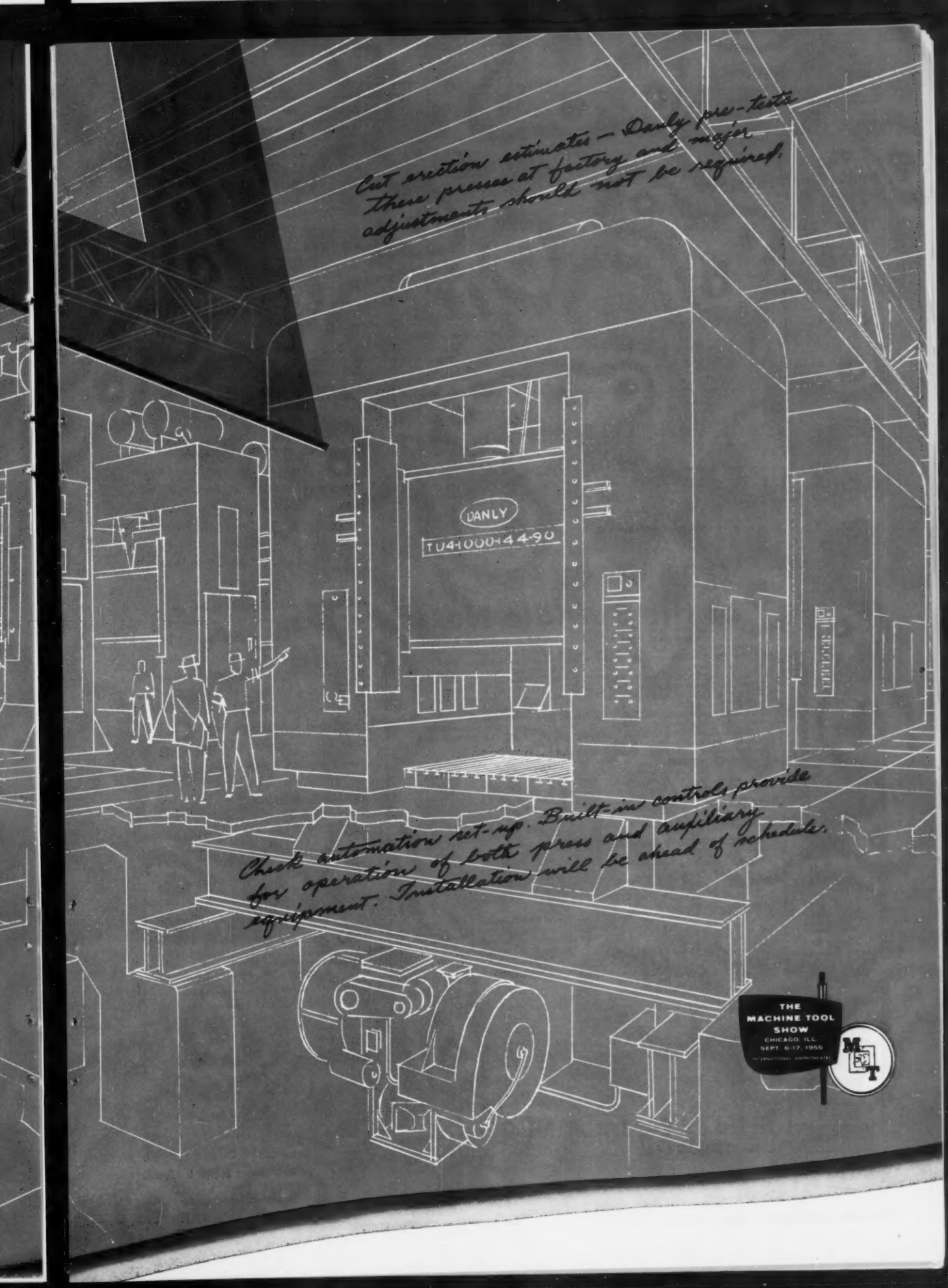


Autofeed

Double Action
Straight Side

Underdrive




Cut erection estimates – Danly pre-tests these presses at factory and major adjustments should not be required.
DANLY
TU4000-44-90
Check automation set-up. Built-in controls provide for operation of both press and auxiliary equipment. Installation will be ahead of schedule.
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CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATER
MT

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Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cee Mfg. Co., 21-25 44th Ave., L. I. C., N. Y.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St. Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I. York 17, N. Y.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVING TOOLS, Internal

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HAMMERS, Drop

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Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

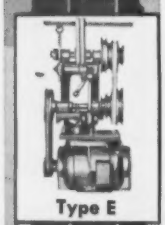
(*Continued on page* 392)

SHELDON
CHICAGO U. S. A.

MORE POWER at the Spindle Nose

The greater work capacity of 10", 11" and 13" Sheldon Precision Lathes comes in part from their extra power. Compared to other lathes of similar swing and price, Sheldon Lathes are built to take larger motors. Sheldon Motor drives are better engineered and better built. In place of a single ordinary V-belt to drive the lathe spindle, these Lathes have twin, Neoprene, cog V-belts (each capable of delivering 40% more power than an ordinary V-belt).

The greater wrap-around of Sheldon's twin cog V-belts not only delivers more power at the spindle nose—permitting heavier cuts, they also eliminate slippage at the spindle—increase accuracy of work. Made of oil, heat and static resistant Neoprene, Sheldon's Spindle belts have a longer life expectancy than other belts of similar type.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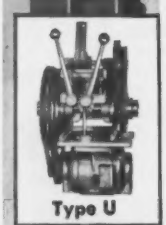
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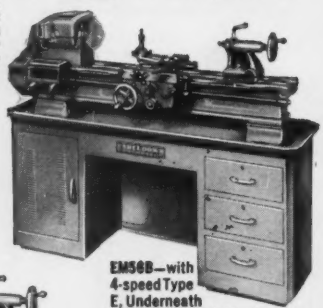
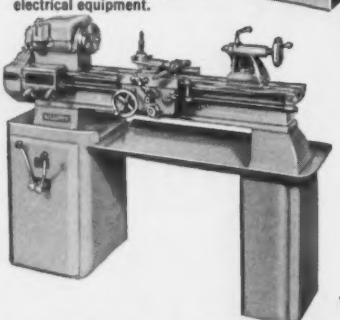


UM56P—with 4-speed external lever shift type U, underneath Motor Drive in heavy cast iron Pedestal base with storage space in tailstock leg. $1434.00 F. O. B. Chicago, less electrical equipment.



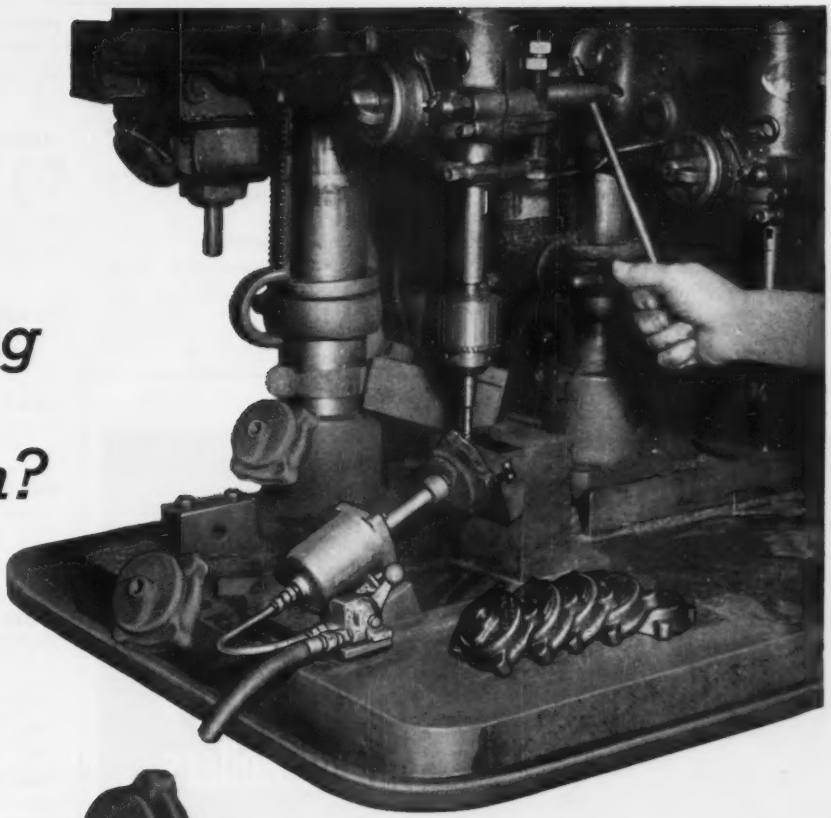
EM56B—with 4-speed Type E, Underneath Motor Drive in Cabinet base. $1467.00 F. O. B. Chicago, less electrical equipment.

Write for New G-55 Catalog

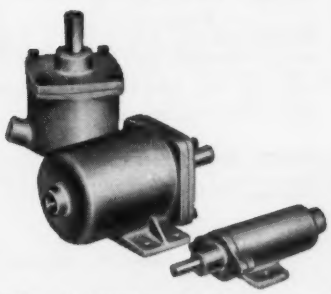
SHELDON MACHINE CO., INC.
4246 N. KNOX AVE. CHICAGO 41, ILLINOIS

For more information on products advertised, use Inquiry Card, page 277

Clamping Problem?



SCHRADER has the answer!



Schrader Air Clamping Cylinders are available either base or leg mounted, in 1", 2¼" and 3" diameters delivering a 2" or 1" stroke. A wide selection of Schrader Valves is available to operate this equipment.

Schrader
REG. U. S. PAT. OFF.

Leaders in air control since 1844

The **Schrader Air Clamping Cylinder** is actually a bantam air cylinder that can *add several minutes* to each worker's production hour . . . eliminate the need for slow, manual clamps.

Think of all the clamping operations in your own shop. Milling machines . . . drill presses . . . power presses . . . welders . . . gluers — and many dozens of other machines that are now idling for ten or fifteen seconds while operators go through slow clamping operations. Why not save time — and operator annoyance — with fast, convenient Schrader Clamping Cylinders, as so many other industrial plants have already done? Remember, you can mount these Schrader Clamping Cylinders anywhere — and actuate them automatically or manually.

For full details on the models available — or any of the hundreds of air control products in the complete Schrader Line — write today. Or, if you prefer, fill out the coupon below.

A. Schrader's Son
Division of Scovill Manufacturing Company, Incorporated
454 Vanderbilt Avenue, Brooklyn 38, N. Y., Dept. E-6

I am interested in more information on _____

Name _____ Title _____

Company _____

Address _____

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS, Portable Electric

Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

HAMMERS, Shaft

Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT

Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

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Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

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Nor-Cote, Inc., 11425 Timken Ave., Van Dyke, Mich.

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See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.

HOISTS, Chain, Etc.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric

Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

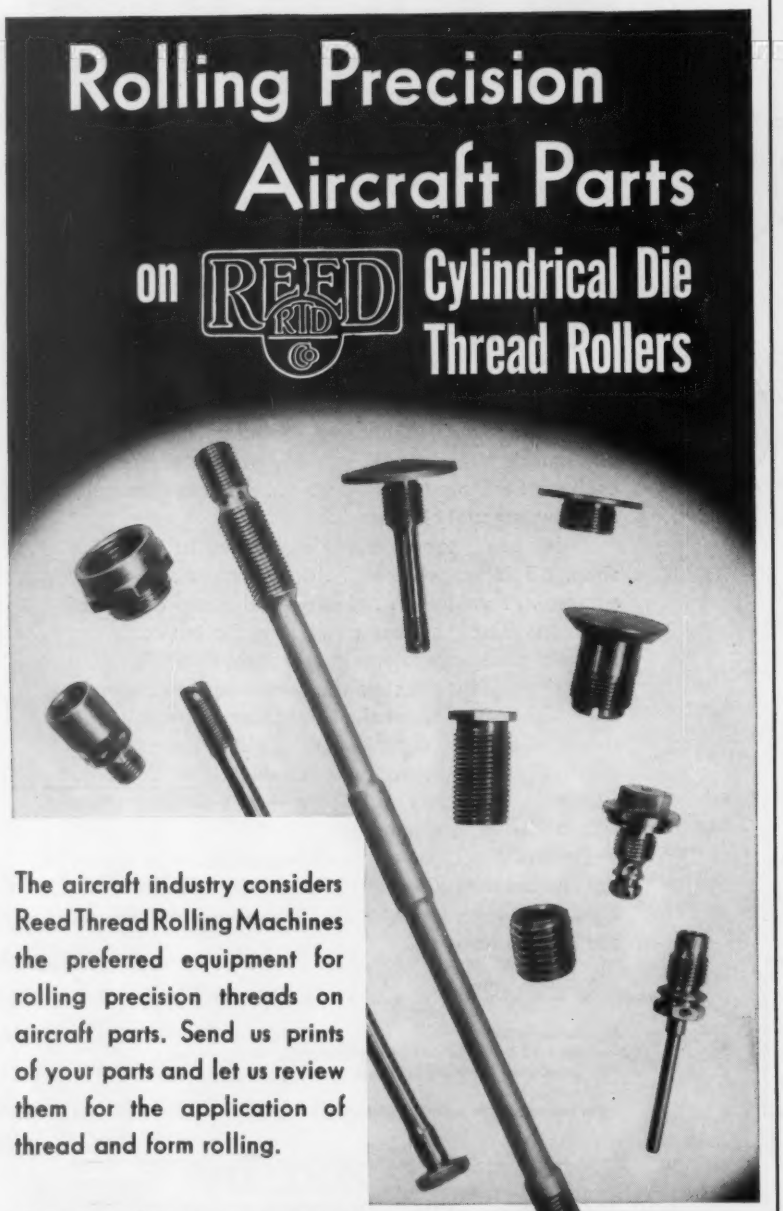
HONING MACHINES, External

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, Internal (Cylinder)

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

(*Continued on page 394*)


Rolling Precision Aircraft Parts
on REED RID Cylindrical Die Thread Rollers
The aircraft industry considers Reed Thread Rolling Machines the preferred equipment for rolling precision threads on aircraft parts. Send us prints of your parts and let us review them for the application of thread and form rolling.
REED ROLLED THREAD DIE CO.
THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS
Worcester, Massachusetts

For more information on products advertised, use Inquiry Card, page 277

AIRengineering at work
REPORT No. 4150.25

Cuts 60 Second Metal Drilling Job to 15 Seconds... with Air Punching Tool

A sub-contractor for a large auto manufacturer formerly used two men, an electric drill and a drilling jig to drill two 1/4" holes in rear auto fenders.

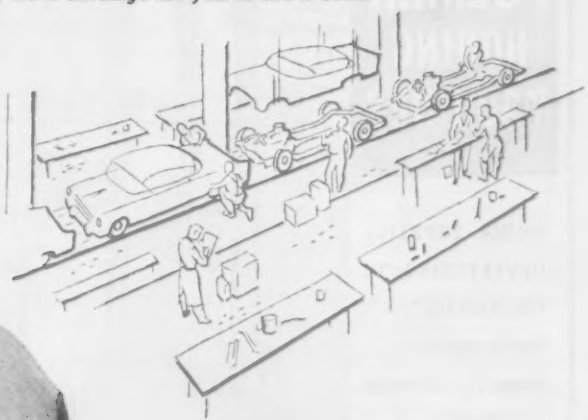
This method required a whole minute and failed to provide uniform results. In addition, paint damage and broken drills caused excess time loss.

AIRengineering by Ingersoll-Rand solved the problem fast. A size AR130 Air Buck Riveter was equipped with special yoke, punches and stripping mechanisms. The holes are now punched four times faster, with closer tolerances and only *one* man is required instead of two.

If you are in a position to encourage cost-savings in your plant, you should see I-R's confidential manual reports on "AIRengineering at Work". Write on your company letterhead and we'll arrange for you to see it soon.

AIRengineering Manual
Over 100 interesting and helpful case history applications of AIRengineering at work.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.



Air Buck Riveter
Punching two 1/4" holes in rear auto fender.

8-257

HONING STONES

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Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

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Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

HYDRAULIC MACHINERY
Tools and equipment

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich
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CUT AWAY METAL FROM INTERNAL CYLINDERS "MOSTEST AND FASTEST" WITH

FULMER HONING MACHINES

SPEED is exact, uniform, constant, removes up to 1 1/2 cu. in. per min.

ACCURACY is achieved through self-aligning hones which remove rough spots of the internal surface and then hone the cylinder to tolerances up to .0001" (±) on ferrous and non-ferrous metals, plastics, glass, etc.

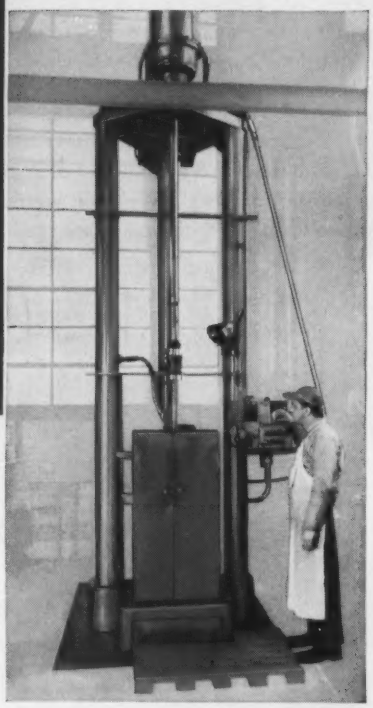

PHOTO taken in plant of the Frank G. Hough Co., Libertyville, Ill., world's largest tractor-shovel manufacturer.

FULMER SUPPLIES "EVERYTHING IN ONE PACKAGE" Honing machines . . . Hones . . . Fixtures . . . Tools.

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Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

INDEXING AND SPACING EQUIPMENT

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Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
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Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
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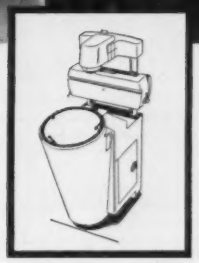
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

(Continued on page 396)



Announcing . . .

a portable, bench-type comparator for either horizontal or vertical projection . . .

the KODAK CONTOUR PROJECTOR, Model 8

Here's how Kodak brings you new economy in checking small parts by projection gaging:

Two-way staging: Parts can be staged in simple holding fixtures for horizontal projection on the Model 8. Or you can turn the machine on end for vertical projection and simply lay the workpiece on an easily mounted plate-glass stage. Only Kodak provides this choice to simplify your staging.

Choice of magnification: Six precision projection lenses (10×, 20×, 31¼×, 50×, 62½× and 100×) are quickly interchangeable, seat positively for precise rated magnification.

Large work area: Kodak's unique relay lens system gives you uniform, ample working distance at *all* magnifications.

Easily portable: The cast-aluminum Model 8 is easily portable, designed for use on bench or table.

Bright screen image: Coated lenses which increase light transmission—plus a special Fresnel lens back of the screen—yield a bright image, permitting you to use the Model 8 anywhere in the plant.

Optical stability: Kodak's famed Ektar Projection Lenses and rigidly built lens mounts and housings insure accurate performance year after year, provide precision equal to that of large toolroom projectors.

Easy to use: Operators learn inspection procedures quickly, using optical gaging on the Model 8. Erect, right-reading image with both vertical and horizontal projection cuts down training time. Air-cooled lamphouse and handy controls assure operator ease.

EASTMAN KODAK COMPANY
Special Products Sales Division
Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

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Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

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Enterprise Mch. Parts Corp., Detroit, Mich.

JACKS, Planer
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

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Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
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JOINTS
See Fittings, Hydraulic, Pneumatic, Etc.

KEYS, Woodruff, Machine, Special
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One Priceless Element In Every

POPE PRECISION SPINDLE

THE *Confidence* OF ITS USER

You can have complete *confidence* in the antifriction bearings POPE puts into your spindles.

They are made to new super-precision tolerances.

You can depend upon Pope Spindles for the continuous production of accurate parts, fast removal of the surplus metal and fine low micro-inch surface finishes.

POPE Spindles have radial and axial rigidity capable of properly supporting modern cutting tools on high production work.

The shafts are large for extra rigidity and have enormous excess capacity.

With the POPE SYSTEM of Grease Lubrication used successfully for thirty-four years, there is no internal radial clearance for oil film in the bearings — none is required. Instead, the bearings are permanently internally preloaded for accurate centering and positioning of the shaft.

POPE leadership in spindle design and constant PROGRESS in engineering and manufacturing reduce your tolerances and production costs.

For trouble-free operation
YOU CAN SPECIFY POPE SPINDLES WITH *Confidence*

No. 103

Specify POPE PRECISION SPINDLES
POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

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Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS
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Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES
Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand
Crane Packing Co., 1800 Cuyler Ave., Chicago.
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LATHE ATTACHMENTS
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Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

(*Continued on page* 398)

For more information on products advertised, use Inquiry Card, page 277

a Natural when it comes to Passes

Typical Monarch Roll Turning Story

12¼ hrs.

vs

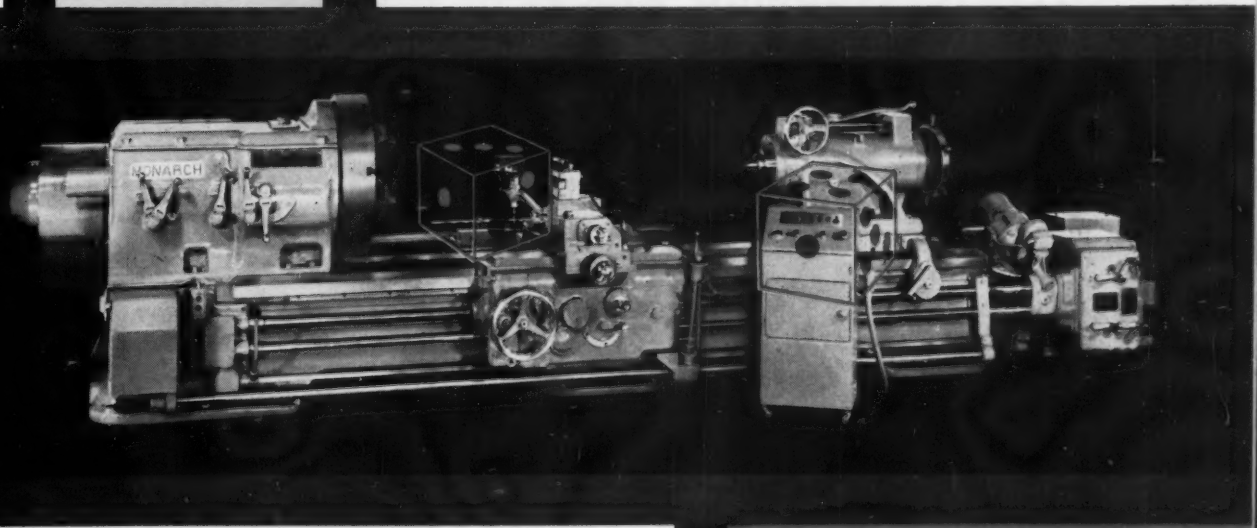
Old 31 hrs.

Why roll it the hard way when faster turning time is what comes naturally to our Heavy Duty Roll-Turner with Monarch-Keller controls? Every job report we ever got from a user confirms it! Consider this one:

Part is a 10" diameter roll having 30" body length and made of grain iron with a hardness of 60-65 scleroscope. It has 13 half-round passes ranging from $1\frac{5}{8}$" to $1\frac{13}{16}$" diameter. Monarch rough turning time is 9¼ hrs.; finish turning time, 3 hours.—*total time, 12¼ hrs.*

For comparison, the most competent roll turner in the user's plant tried to compete on an old-style roll lathe. Working all-out, and much harder than the other operator, he still required 24 hrs. roughing time; 7 hrs. finishing time—*a total of 31 hrs.*

Why handicap yourself with costly old methods any longer? It's a sure bet that we can save time and money for you. Write for the complete story—illustrated Booklet #1302.



"SAVE IN MANY WAYS With The Monarch Heavy Duty Roll-Turner"

1. On all types of rolls which lend themselves to this method of turning, floor to floor turning time averages from ⅓ to ¼ of the former time.

2. With standard carbide turning tools with regular tool grinds, hundreds of form tools required by conventional methods are not needed. Tools can be changed with no sacrifice of contour accuracy.

3. With template controlled contour forming, matching rolls in pairs is unnecessary. Each roll turned from any given template is identical. One of pair of rolls can be redressed or new roll turned without matching the other.

4. When redressing a roll, the operator may quickly check the point of greatest wear with the corresponding point on the template after which he can be certain that the entire roll will clean up on the first pass.

5. The same template is used for both the rough and finish passes. Thus finishing immediately follows roughing with no set-up change other than the required tool change.

6. Operator cannot modify roll shape. As the template form is dimensionally the same as forms to be turned on the roll, their longitudinal placement and relationship are sure to be accurate.

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

THE MONARCH MACHINE TOOL COMPANY
Sidney, Ohio

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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Automatic

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

(Continued on page 402)

finest

HORIZONTAL BORING MACHINES
VERTICAL BORING MILLS
PLANERS

lowest prices

here are the most modern machine tools on the market today, incorporating the finest in engineering principles and the most advanced techniques.

HORIZONTAL BORING DRILLING MILLING MACHINES

3", 3½", 4", 5", 6" SPINDLES.
45 SPEEDS — 36 MILLING FEEDS
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TABLE — FLOOR — PLANER TYPES

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30", 36", 48", 60", 72", 96", 120" SIZES
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24", 36", 48", 60", 72", 96", 120" SIZES
OPENSIDE — DOUBLE HOUSING
HYDRAULIC & MOTOR DRIVEN

SPECIAL MACHINE TOOLS

YOUNG MACHINE TOOL DIV.

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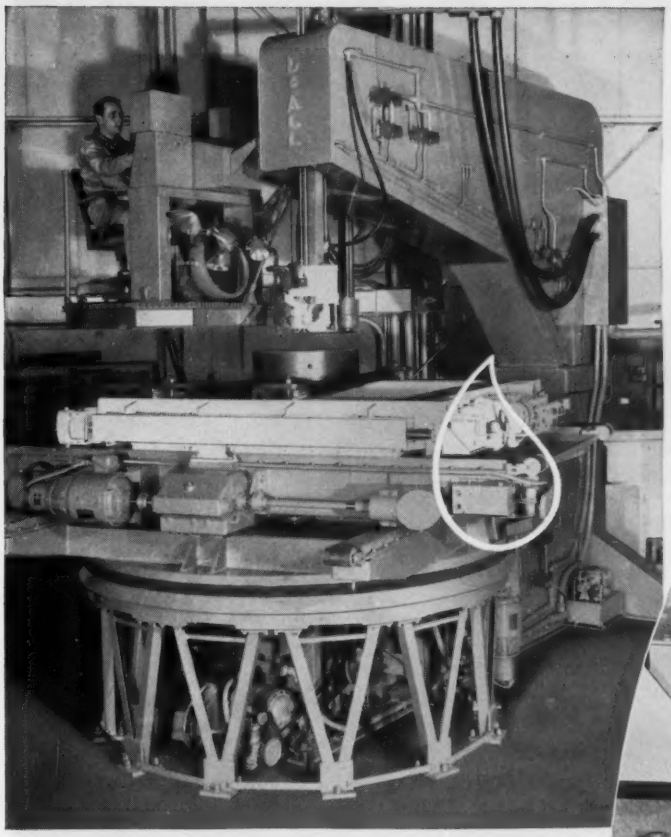
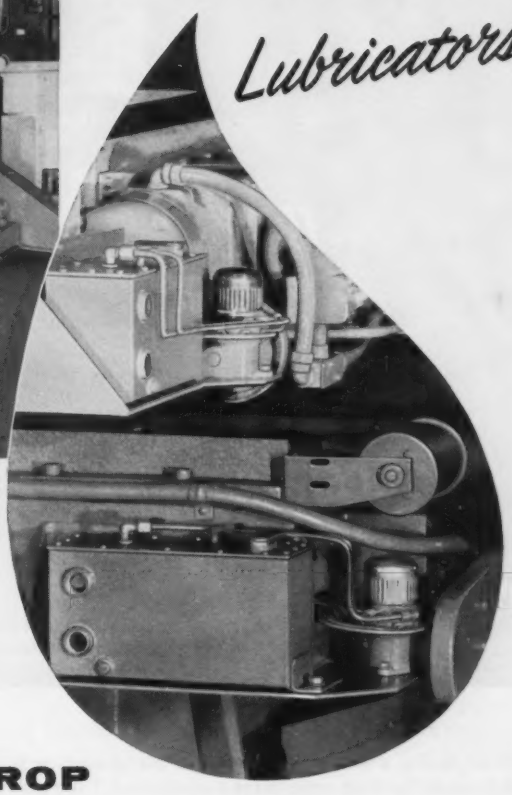


MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED

...MADISON-KIPP *Lubricators*



Two Madison-Kipp OL Lubricators installed on the world's largest band machine and die filer, manufactured by the DoALL Co., Des Plaines, Illinois...Operated by remote control, they machine 10-ton extrusion dies for the Air Force "Heavy Press Program."

Fresh Oil...

BY THE MEASURED DROP

...from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

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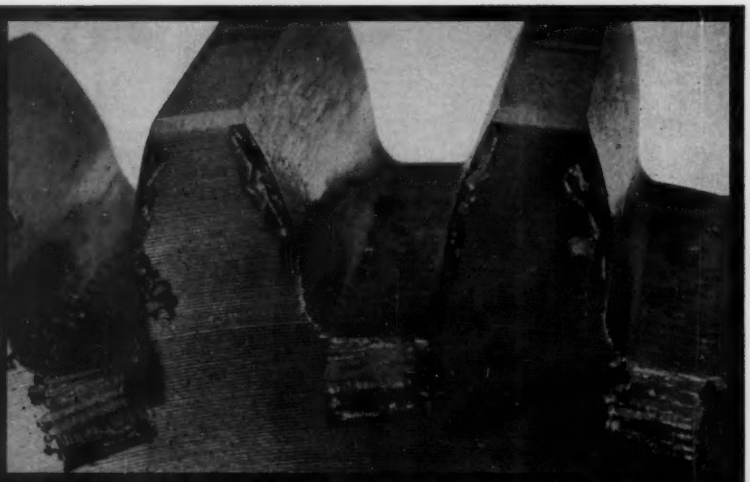
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

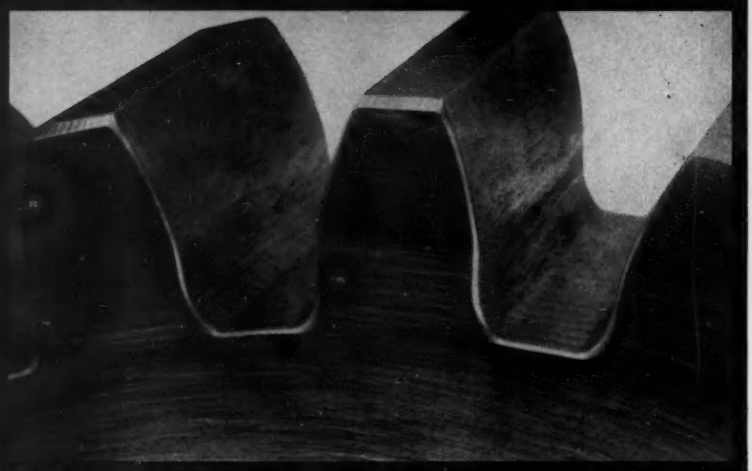
• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

Osborn Brushamatic

. . . rough to finish in one operation



BEFORE BRUSHING. Edges have heavy burrs. Sharp corners permit high stress concentrations . . . possible sources for failure.



AFTER BRUSHING. Burrs are gone . . . smooth, uniform blend on junctures of gear face and involute increase tooth strength.

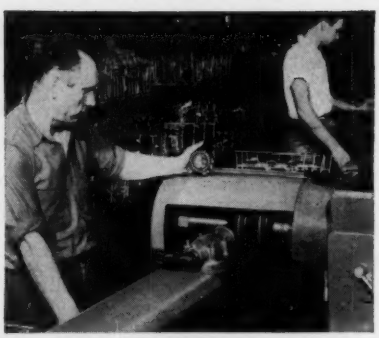
At the push of a button, you can now blend surface junctures on gear teeth . . . at the same time burrs are removed. Each gear tooth is uniform in quality. Production is less costly because it's simpler, faster.

Gears finished on Osborn Brushamatics are stronger, more dependable. By removing sharp corners, stress concentrations are avoided. Thus, there is less chance for failure in severe service.

Your operator simply loads and unloads the work. Brushamatic rotates the piece against revolving brushes on preset time cycles.

An **O**sborn **B**rushing **A**nalyst can show you how to put Brushamatic to work for you. One machine can handle a large variety of work . . . is easy to set up from job to job. Call or write *The Osborn Manufacturing Company, Dept. D-30, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

*Trade-Mark



OSBORN BRUSHAMATIC*. *Saves over 1000 manhours every year. Capable of handling over 2000 parts a day.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

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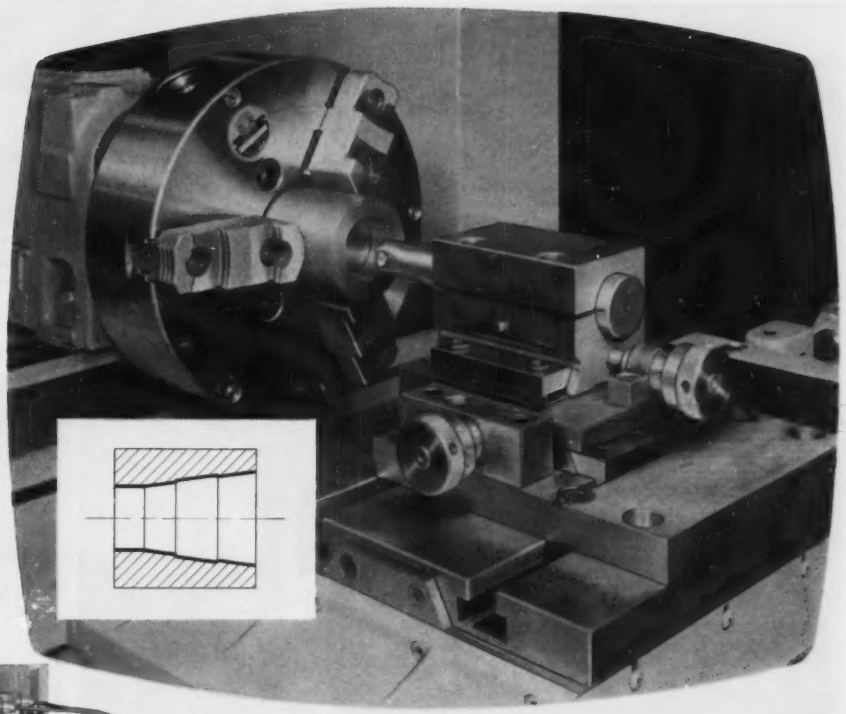
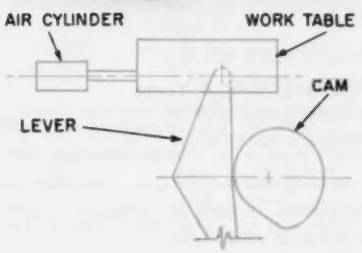
Get precision boring results like this...



...on the BRYANT precision boring machine!

Part—Chuck body, A. I. S. I. 8747 steel, 18 to 20 Rockwell "C"
Operation—Combined taper and straight boring
Hole dimensions—1.875 + .005 at large end, 8° taper, 3" long
Cutting speed—1500 R. P. M., 475 to 725 S. F. M.
Feed—6 I. P. M., Lead: .004
Finish Required—40 to 60 micro-inches
Production—63 pieces per hour at 100%



Be sure to see Bryant at the Machine Tool Show ***Booth 1015***

This Bryant Boring Machine is ideal for precision boring. Its many proven features ensure uniform fine finishes and utmost accuracy... at peak production rates. And you can get these results in precision drilling, turning, facing, grooving and contour boring and turning... as well as precision boring.

The Bryant 998 has basic, rigid machine design. The table is actuated mechanically by a precision cam and lever unit. This feature provides positive control of the cycle at all times. It also eliminates variation due to temperature change of a hydraulic system. Fine finishes are assured by the smooth, uniform table motion. The table moves on two 4"-diameter solid steel slide bars firmly bolted to the bed. Two anti-friction, pre-loaded ball bearings on each of these bars support the table. This construction provides a metal-to-metal contact which eliminates shifting due to oil film. *Write for Bryant 998 Job Folder.*

BRYANT

chucking grinder co.

20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

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Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom

LATHES, Turret

Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

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LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
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Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

(*Continued on page* 406)

The PROFILOMETER® can help you get

90% to 800% MORE PIECES PER GRIND

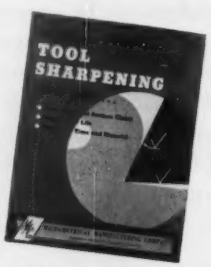
from cutting tools of every type!

WELL-KNOWN COMPANIES are getting *90% to 800% more pieces per grind* — with important savings in production time, tool-sharpening time, and tool replacement cost. Here's how they do it:

In sharpening, they grind or lap the tool faces to a finish of 1 to 5 microinches. A difference of a few microinches can vitally affect performance; so they *specify* the microinch finish and *measure* it with the PROFILOMETER to make SURE. The Profilometer's versatility and dependable accuracy make it ideal for such work; and the savings obtained far outweigh the little time required to make such measurements.

FREE BULLETIN L22

gives *case histories* of savings obtained — explains in detail *all* the benefits obtainable by smooth-finishing cutting tools. Want a copy? Write today!



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Stop dressing away valuable wheels and start getting the very most out of your grinding dollar.

Stop throwing away dollars in scrapped parts and start using the coolest cutting wheels you ever saw.

The amazing M M process, made exclusively by Macklin, which has been setting new high standards of performance in the carbide grinding field, is now available in Aluminum Oxide material for those "hard to grind" steels.

The fine grain, in pellet form, distributed throughout the wheel gives a constant flow of fine abrasive between the wheel and the work and the self-dressing action that saves you time and money.

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MACKLIN COMPANY

Manufacturers of GRINDING WHEELS AND OTHER ABRASIVE PRODUCTS

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HOLMES Combination HYDRAULIC FORCING and STRAIGHTENING PRESS

Simply by raising hood and lowering Swing-Out Motor and Pump Panel--entire working mechanism is made immediately accessible for service.

Two Machines In One--Multiple Use... Remarkable Versatility...Ready Adaptability...Low Initial Cost.

In practically any metal fabricating operation, this much-talked-about new press will save time, labor, and material--and pay for itself in a hurry. And no wonder, just check these five major exclusive features:

- ★ *QUICK-CHANGE TABLES*--enable one press to do both forcing and straightening.
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- ★ *SWING-OUT MOTOR AND PUMP PANEL*--easy accessibility, maintenance, service.
- ★ *ADJUSTABLE ILLUMINATION*--frosted incandescent tube lights whole work area.

If you're interested in increasing output...and... cutting costs--why not get ALL the details on the new Holmes Combination Hydraulic Forcing and Straightening Press? Write for Specifications Manual--TODAY. It's yours for the asking--with no obligation whatever.

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Hydraulic Presses Since 1901

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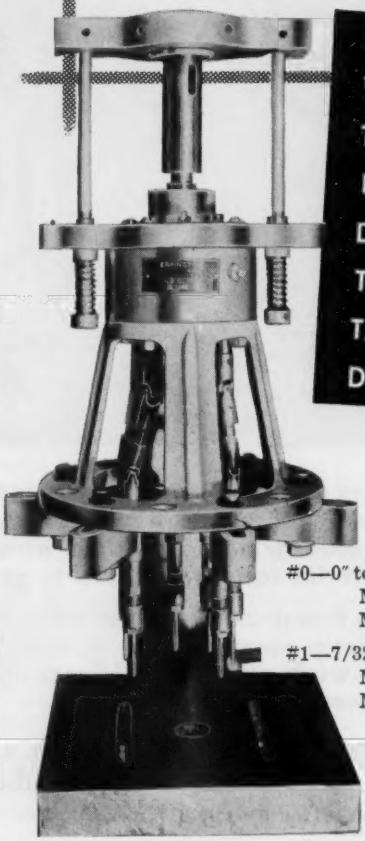
ERRINGTON

UNIVERSAL JOINT ADJUSTABLE TAPPING & DRILLING HEAD

Here's another hi-speed production tool from Errington. This dependable tool is adjustable to any pattern of holes . . . is available with 4 or 6 spindles. Positive clutch drive and reverse. Head made of the best grade sand Cast Aluminum with hardened and ground gears and spindles (made in one piece). Full grooved ball thrust bearings at all thrust points and Oilite bronze radial bearings. *Remember to do more . . . better . . . faster . . .* rely on Errington Hi-Speed Production Tools.



LESS THAN ½ MINUTE TO CHANGE HEAD FROM DRILLING TO TAPPING OR TAPPING TO DRILLING

#0—0" to ¼" Tap Capacity
Min. centers 11/16"
Max. Pattern 5¼"

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Min. centers 1½"
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Established 1891
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at "CHICAGO" we DO something about it!

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The CHICAGO SCREW COMPANY
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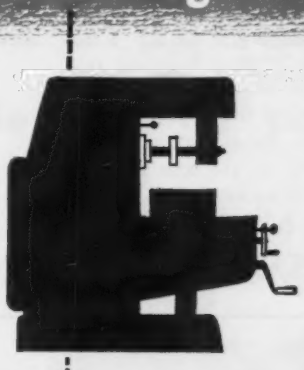
The complete Chicago "Safety Plus" line includes in alloy steel: Socket Set Screws • Socket Head Cap Screws • Socket Stripper Bolts • Square Head Dog Point Set Screws • Socket Pipe Plugs • Flat Head Socket Cap Screws • Dowel Pins • Hexagon Keys and Key Kits • Also Socket Set Screws and Socket Head Cap Screws in Stainless. The complete "Chicago" line of Standard Products includes: Hexagon Head Cap Screws in steel—bright and Grade 5, heat treated, also in brass and stainless • Square Head and Headless Set Screws • Taper Pins • Steel Studs Flat and Fillister Head Steel Cap Screws • Hexagon Nuts in steel, brass and stainless.

production begins with



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Contact Columbus Die-Tool & Machine Co. first—when you have a special machine problem. They are nationally known as expert designers and builders of special machinery and equipment . . . have been for over 46 years.

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AND MACHINE COMPANY
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ESTABLISHED 1906

Manufacturers of
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SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

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Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
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Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

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Madison-Kipp Corp., Madison, Wis.
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Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

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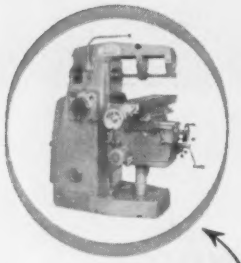
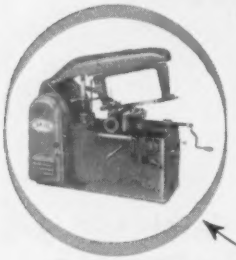
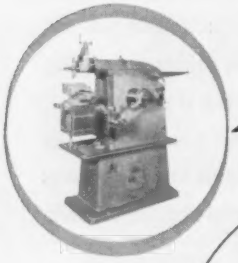
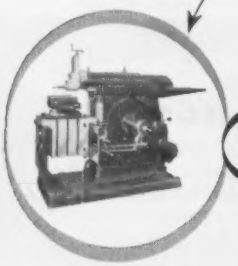
du Mont Corp., Greenfield, Mass.

Swedish Craftsmanship!









headquarters

FOR THE FINEST
SWEDISH MACHINE TOOLS

Austin is American headquarters for the fine machine tools that are manufactured in the modern Swedish machine tool center of Värnamo.

Built with the painstaking workmanship and quality materials that characterize Swedish products, these machine tools, since their introduction in the U.S.A., have earned an enviable reputation for accuracy and dependability in toolroom and production line. All machines comply fully with U. S. Standards.

SAJO #2 ALL GEARED MILLING MACHINES — plain and universal models — light and standard types, all built to modern design to meet industry's demand for fast, simplified operation while maintaining maximum accuracy. Available with longitudinal power feed only or with power feed and rapid traverse in all directions. Offered with full line of accessories.

SAJO HYDRAULIC HACKSAWS — Utility and Production Models — 6" x 6", 9" x 9" and 10" x 10" capacities. These sturdy machines, for intermittent or production duty, have unique patented features and are attractively priced. Sajo Hacksaws represent exceptional values in cutting off equipment.

PREMA 13" SHAPER — a "mighty mite" — ideal for applications where large shapers are not justified. "Big Shaper" performance and accuracy at modest cost makes the Prema a profitable addition in the toolroom or on light production work.

VMA SHAPERS are available in both standard and heavy duty models — 14" to 26" length of stroke. These rugged amply powered machines provide speedy set-up, ease of operation and maximum stamina in the toolroom or production line. Automatic lubrication and table power rapid traverse are standard on heavy duty models. Universal table and other accessories are available.

Service and spare parts available from us or from our dealers in principal cities.

For complete details, illustrated catalogs and information as to reference installation in your vicinity write to

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76-E MAMARONECK AVENUE, P. O. BOX 430, WHITE PLAINS, N. Y.

Look for the Austin Seal — your full guarantee of satisfaction.

MANDRELS

See Arbors and Mandrels.

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Crane Packing Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Max Wyler, 611 W. 43rd St., New York 36, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

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METAL, Bearings

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METAL FINISHINGS

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METERS

See Recording Instruments

MICROMETERS

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co. Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg., Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield, Mass.

(Continued on page 410)

Zagar Gearless Drill Heads

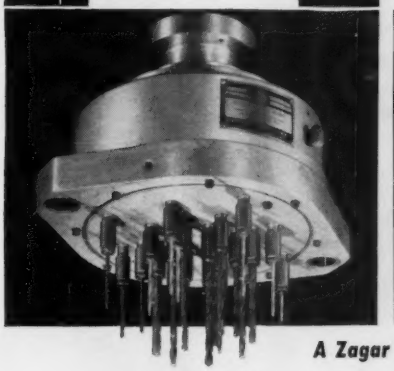
put 4 big advantages to work for you

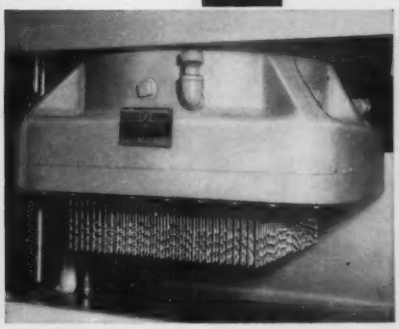
Any number of holes

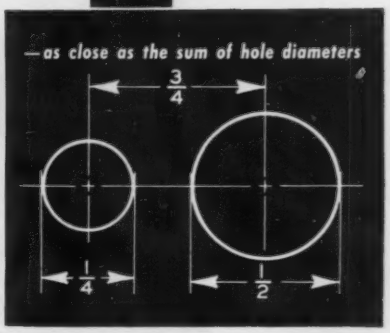
Any hole pattern

Any material

On all centers





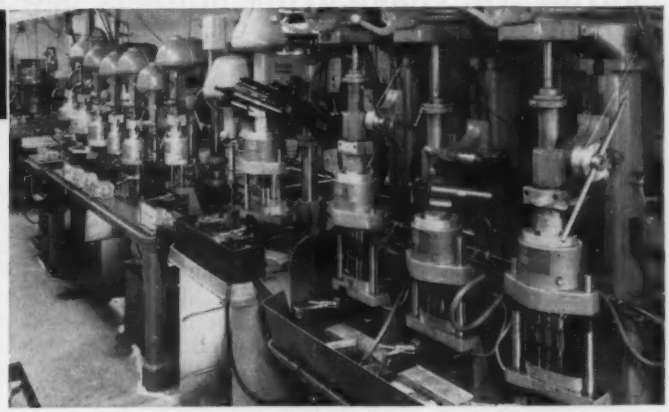


A Zagar drill head is never obsolete. Zagar can re-locate spindles for other hole patterns.

Can you visualize the savings made possible by drilling up to 1000 holes at one pass? Zagar standard practice can handle any machinable material up to 1½" diameter. Holes of varying diameters can be drilled to form any pattern. Zagar Gearless Drill Heads, their efficiency proven by many years' success, can be installed on existing drill presses. Or, Zagar will lay out the necessary tooling for your entire job. May we see your sample parts and study your requirements? There is only one *right* answer—one *best* answer—for those requirements. May we supply it?

Let ZAGAR tooling plan the complete job for you

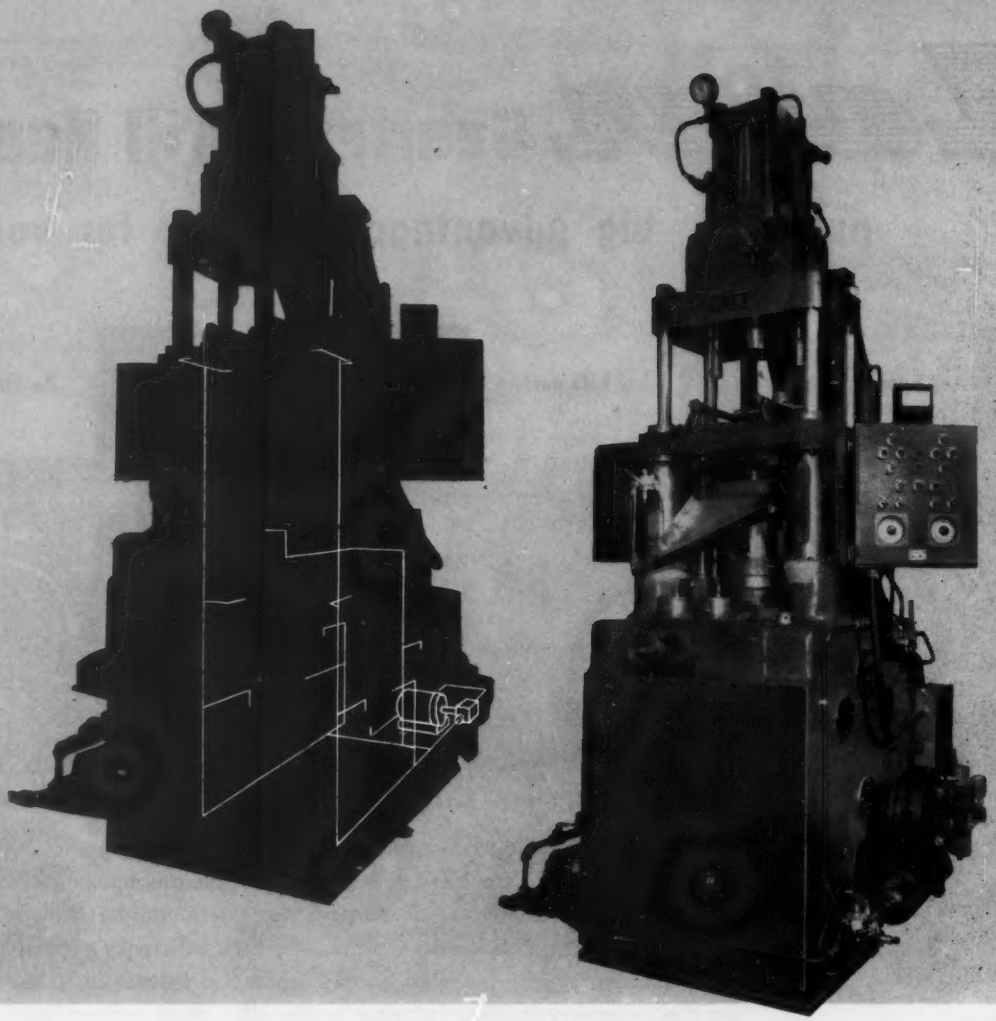
Whether your runs are long or short, let Zagar engineering survey your needs with a view to saving you the cost of special machines. In the case at the right two lines of *standardized* self-clamping drill jigs ream, tap and drill an aluminum die casting, both valve body and cover. The problem of limited production was readily solved. What, sir, are your requirements?



ZAGAR TOOL, INC. 24000 LAKELAND BOULEVARD, CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

Get more information via Zagar's Engineering Manual "M-6".



Model L

AUTOMATIC LUBRICATION protects new Baldwin powdered metal presses

Baldwin Model "L" and "C" powdered metal presses are just what you need for highest-quality and lowest-cost production. That's true because these new 50 and 100 ton presses are the first designed specifically for compacting metal powders.

A big reason why you'll get such low cost production is their automatic lubrication. In both presses a gear type oil pump, independently driven by a fractional horsepower motor, automatically lubricates all moving parts continuously. It forces filtered oil through a drilled crankshaft to the crank and connecting rod bearings. It pressure lubricates all other bearings subject to load.

Baldwin Model "L" and "C" presses are designed so that all moving parts are completely enclosed and sealed. Abrasive powder and dirt can't get into the bearings. These presses automatically fail to operate unless there is oil pressure in the lubricating system. An easily serviced oil filter provides further protection.

No other powdered metal presses have been designed just to meet your end product's needs. That's why Baldwin's new presses are your best buy. Only they can give you such uniform compacts and so little press maintenance because they both have automatic lubrication, hydraulic heads, shuttle type feeders, sealed mechanism, simple fill adjustments and variable cycling.

For more details about "L" and "C" please write to our Dept. 3819, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

EDDYSTONE DIVISION

BALDWIN-LIMA-HAMILTON

Specialists in AUTOMATIC MACHINES

SWANSON

TOOL & MACHINE PRODUCTS INC., ERIE, PA.

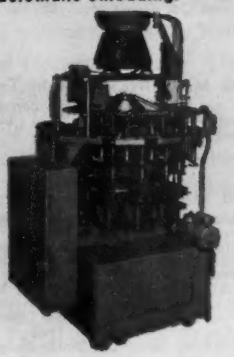
Since 1919

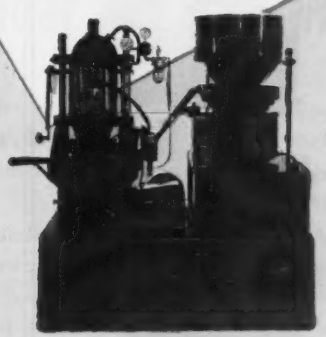
Swanson offers a fully integrated organization experienced in engineering and building special automatic machines for machining, processing and assembling small and medium parts. Illustrated are typical examples of Swanson special machines which are improving quality and lowering costs in a wide range of manufacturing operations. Because they incorporate Swanson-developed standard components wherever applicable, both time and money were saved in their completion.

If you have a problem in automation, tell us about it. We'd like to help.

Your inquiries will be treated in full confidence . . . our recommendations submitted without obligation.

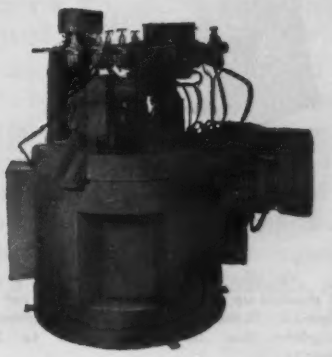
Completely automatic turret type machine for processing four electronic parts simultaneously at each index. Equipped with hopper feed, automatic chucking, transfer mechanism, Swanson-designed memory device and automatic unloading.





An automatic straight-line indexing machine, designed for injecting cement into flash bulb bases. Machines of this type have increased previous production rates by three to five times.

This special machine for drilling, tapping, reaming and counterboring cigarette lighter parts at 1200 per hour, was designed and built around a standard 8-station Swanson Turret Indexing Unit.



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MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

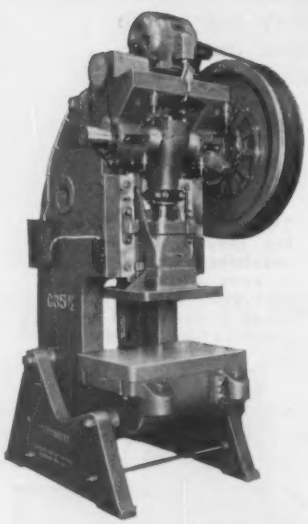
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co. 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile

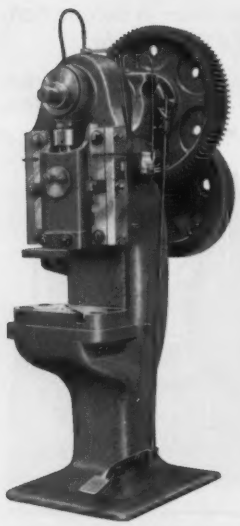
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(*Continued on page* 412)

Need a Punching Press in a hurry?



Ferracute 110-ton O.B.I. Model C-35½ with Single-Point Adjustment on Air-Friction Clutch.



Ferracute Geared Type PG Press

All models up to 110 tons available for prompt shipment. Some sizes, immediate shipment. Complete line includes models to 200-ton capacity.

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FERRACUTE MACHINE COMPANY
Manufacturers of Power Presses and Special Machinery • BRIDGETON, N. J.

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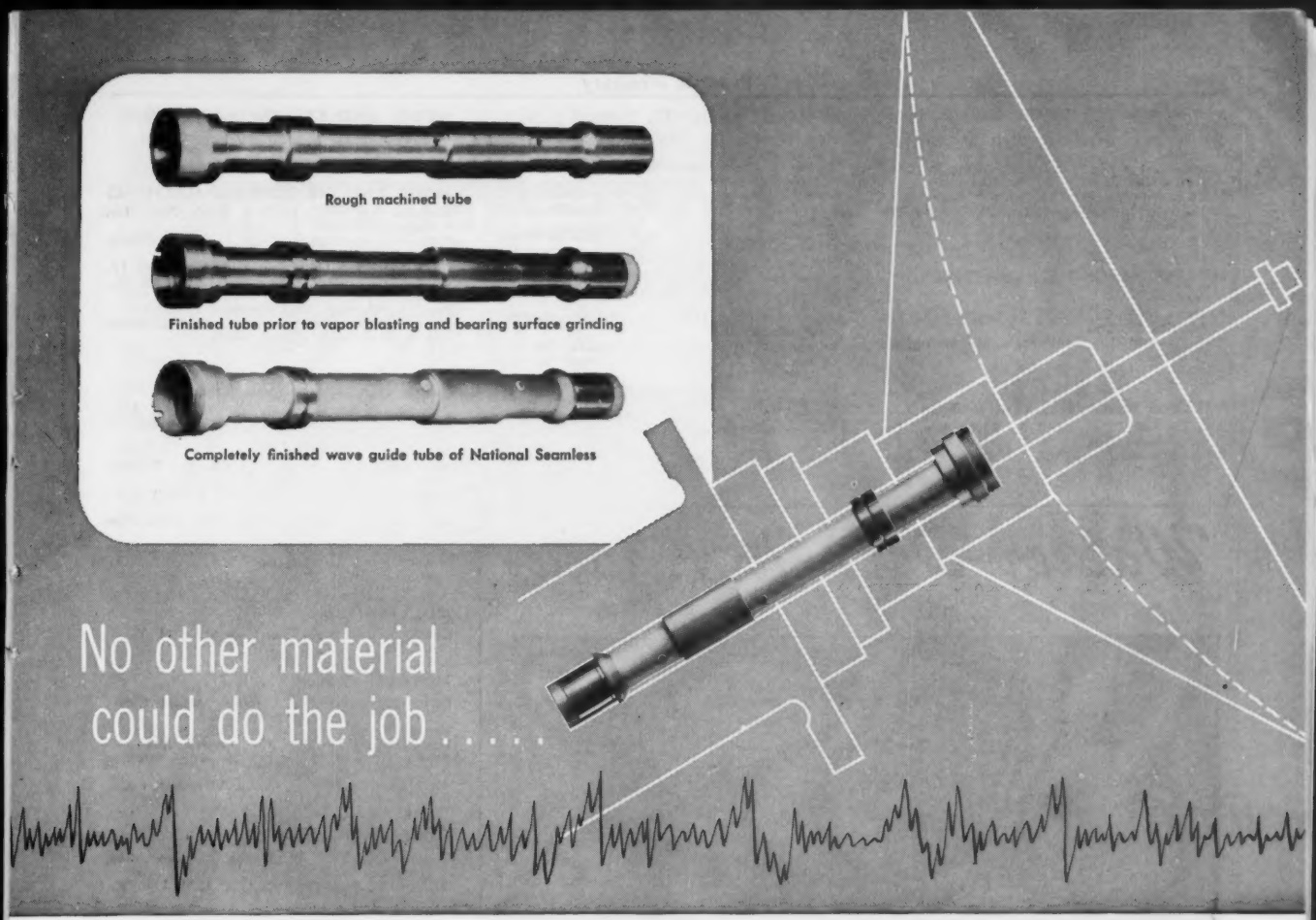
Rough machined tube
Finished tube prior to vapor blasting and bearing surface grinding
Completely finished wave guide tube of National Seamless
No other material could do the job . . . . .

National Seamless Tubes of USS Stainless Steel chosen for Radar Scanner Wave Guide Tube

The wave guide tube, along with the rotor control, form the central control unit of the Radar Antenna System designed and manufactured by Davis Industries, Inc., of Detroit, Michigan.

Originally, the wave guide tube was manufactured from carbon steel suitably plated to eliminate corrosion. Manufacturing complications and plating difficulties proved this process economically unsound and operationally hazardous. That's why NATIONAL Seamless Tubes of USS Stainless Steel were specified. The 1⅛" I.D., ½" wall seamless USS Stainless Steel tubes offered a clean job that required no plating and solved the corrosion problems. In addition, only seamless steel tubing could meet the weight and strength factors required.

The superior strength, consistent uniformity, and dimensional accuracy of NATIONAL Tube's Seamless Steel Tubing make it ideal for all types of vital applications. It is available in a wide range of diameters, wall thicknesses, various shapes and steel analyses, and is produced to exacting standards by the world's largest manufacturer of tubular steel products. Upon request, our engineers will be glad to make a study of your requirements, and help you apply Seamless Steel Tubing to your particular specifications.

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

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Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

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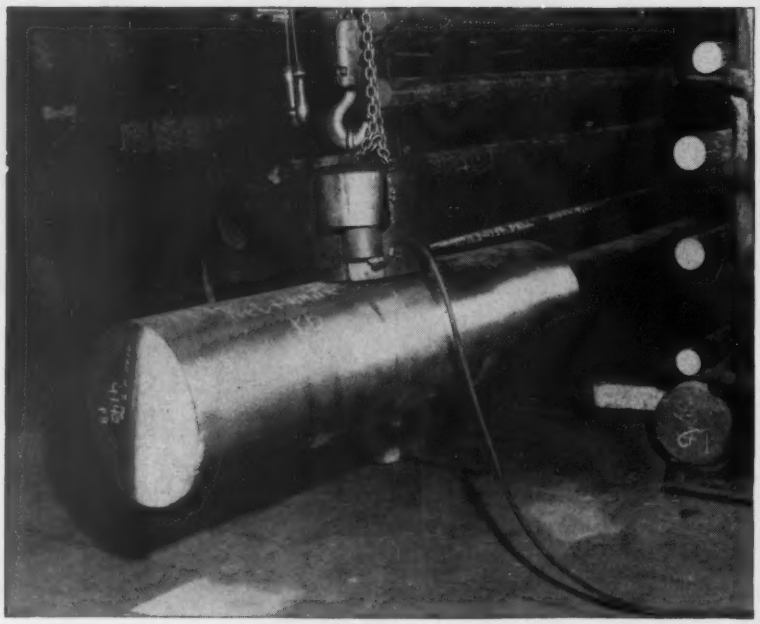
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

Walker Does It Again-



The strongest lifting magnet pound-for-pound ever made. Complete saturation . . . maximum efficiency . . . minimum wattage. Shown here—WALKER magnet lifting, with *12" line contact*, solid steel cylinder 13.5" diameter, weighing 2200 pounds, and utilizing about the same wattage as your kitchen lamp.

WALKER magnets lift up to 50,000 pounds.

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
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Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

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Climax Molybdenum Co., New York, N. Y.

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Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

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Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

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Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking

Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap

Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 414)

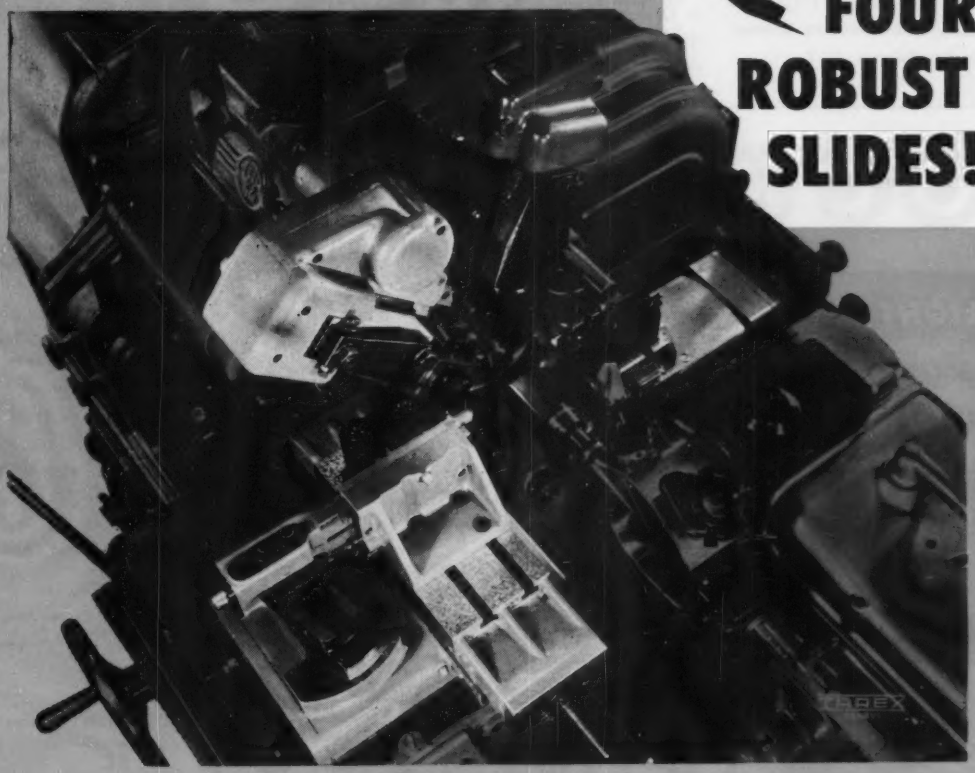
For more information on products advertised, use Inquiry Card, page 277

TAREX

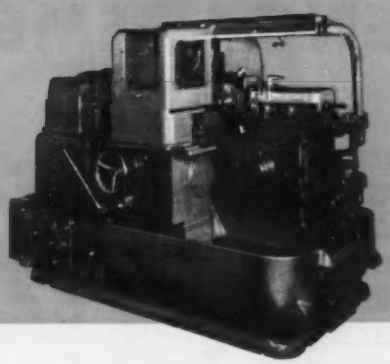
AUTOMATICS

. . . here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:

FOUR ROBUST SLIDES!



The front and rear slides mounted on crossed ways, *permitting radial or lateral movements, or combined to produce tapers or irregular forms.* This allows the use of single point tools in many cases in place of form tools with their inherent side thrust. All tool slides actuated by camming systems having adjustable ratios. (The two upper slides are radial only). Machine throughout is engineered to take American-made tools!



COMPLETE TOOLING and SERVICE in AMERICA.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

OIL SEALS
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble
See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Spelial
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

PAINTING EQUIPMENT, Spray
Lowe Bros. Co., Dayton, Ohio.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

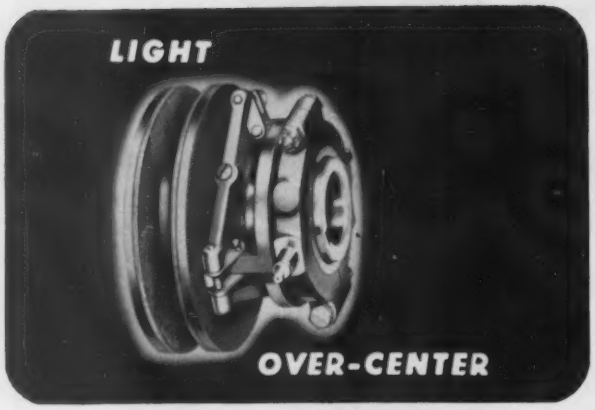
PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

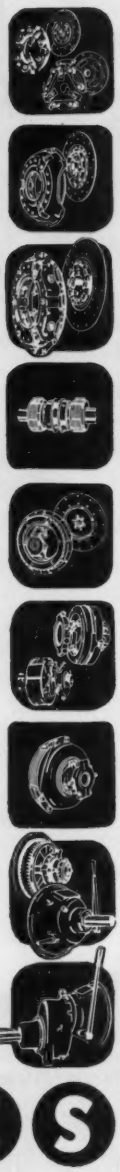
PIPE, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.

(*Continued on page 416*)

ROCKFORD





SMOOTH ENGAGEMENT

COMPACT DESIGN
POWERFUL PULL
SMOOTH ENGAGEMENT *
UNIFORM PRESSURE
FINE ADJUSTMENT
ACCURATE BALANCE
LONG SERVICE LIFE

* The smooth-operating toggle action slides the drive plate along the accurately machined collar, applying the pressure evenly — and directly opposite the facing. The clutch plates are steel and the facing is specially selected for its firm grip, long wear and non-grab qualities.

Send for This Handy Bulletin
Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

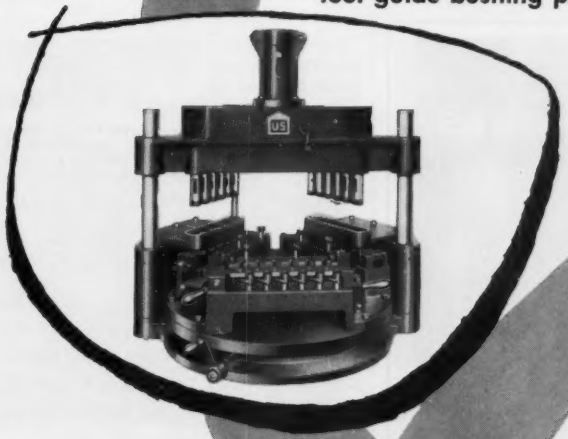
ROCKFORD CLUTCH DIVISION BORG-WARNER
▲ 410 Catherine Street, Rockford, Illinois, U.S.A. ▲

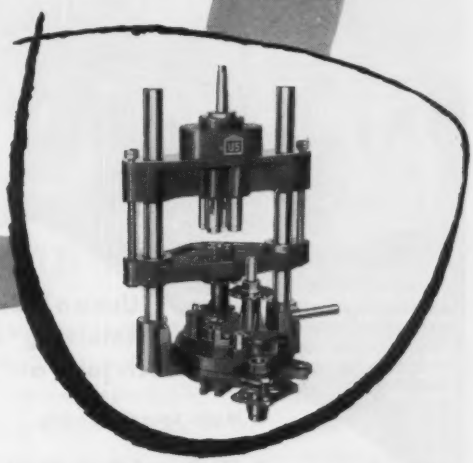
CLUTCHES

For more information on products advertised, use Inquiry Card, page 277

IT'S SAFER TO BUY
DRILL HEADS, FIXTURES and BUSHING PLATES
AS A COMPLETE PACKAGE

The 12-spindle unit shown below has a three-station hand-indexing table with three holding fixtures, complete with tool guide bushing plates.





Shown above is a drill head complete with boring bars with Carboloy-tipped cutters and Stellite wear strips. The indexing table has necessary holding fixtures with bushing guide plate.

The setup, left, has a two-position, hand-indexed fixture.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

US HEADS

UNITED STATES DRILL HEAD COMPANY

616-618 BURNS STREET • CINCINNATI 4, OHIO

Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES

Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLANERS

Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLANERS, Double Housing and Openside

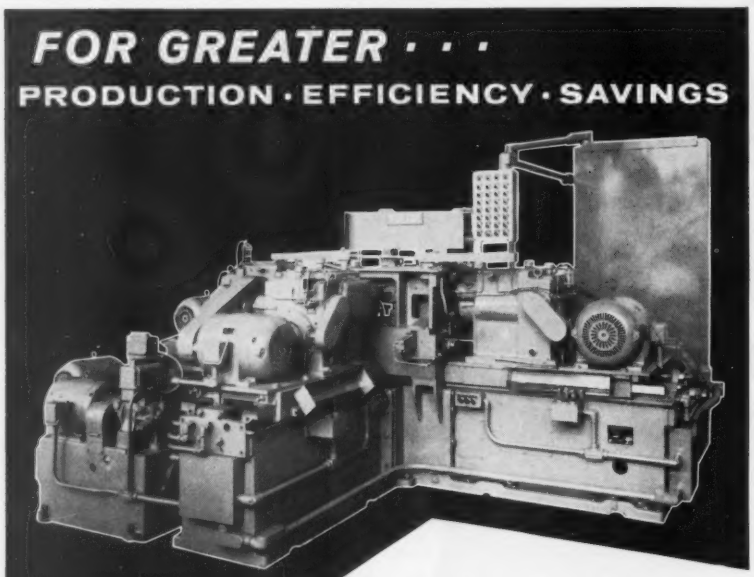
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Racktora, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Angle

Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.



Model MR138 four-way, horizontal machine for boring, counterboring, facing, chamfering and drilling tractor main frame housings.

Use an individually designed "Hole-Hog" Machine Tool for such jobs as:

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

Over 50 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

Representatives in principal cities.

103

MOLINE TOOL COMPANY
100 20TH STREET MOLINE, ILLINOIS

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Brush Electronics Co., 3405 Perkins Ave., Cleveland, Ohio.
Challenge Machinery Co., Grand Haven, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Onsrud Machine Works Inc., 3940 Palmer St., Chicago, Ill.

POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

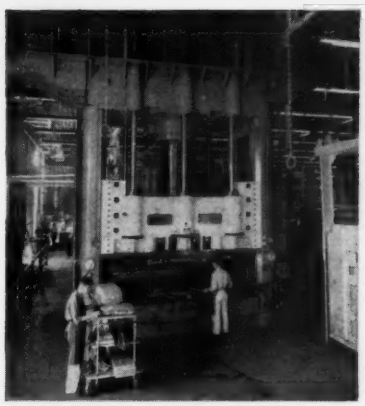
POWER UNITS, Hydraulic

See Hydraulic Power Units or Tools Heads

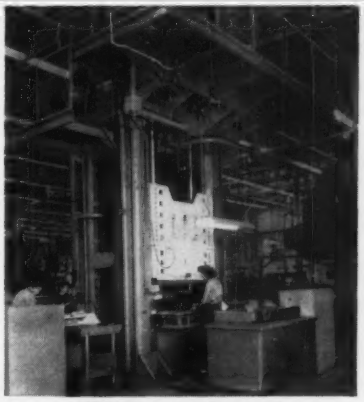
PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.

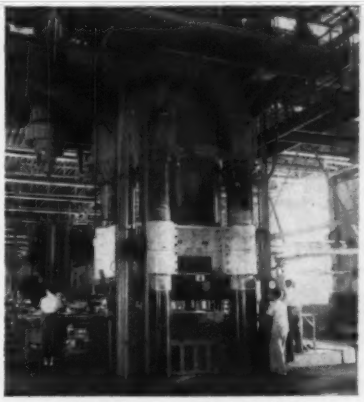
(*Continued on page* 418)



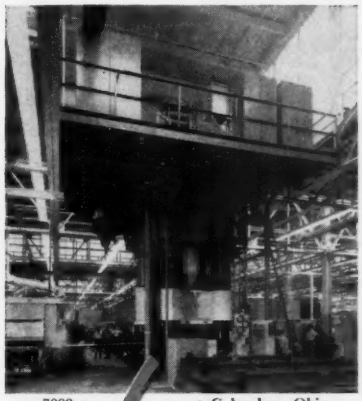
1100 ton press at Los Angeles



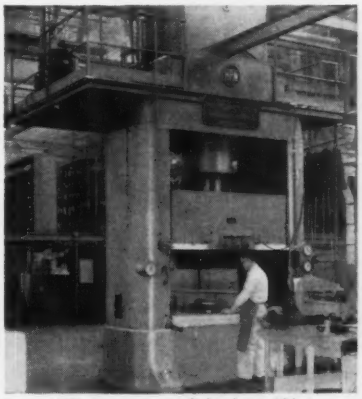
1000 ton press at Los Angeles



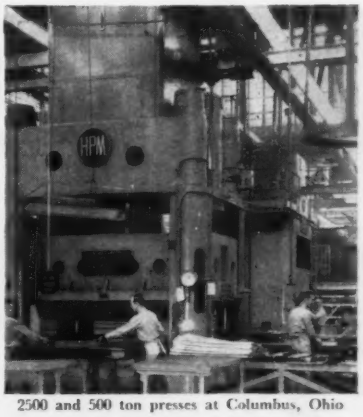
7000 ton press at Los Angeles



7000 ton press at Columbus, Ohio

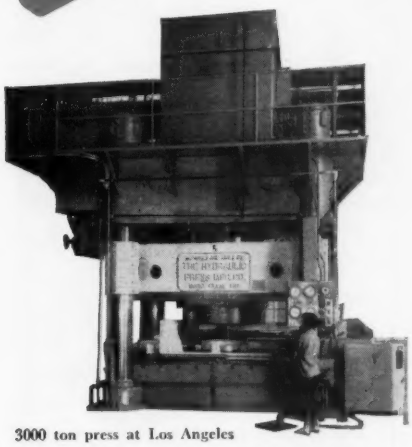


500 ton press at Columbus, Ohio



2500 and 500 ton presses at Columbus, Ohio

Look AT THE H-P-Ms at North American Aviation, Inc.



3000 ton press at Los Angeles

There's $2,000,000 invested in H-P-M presses at North American plants. And, they're a good investment! Why? Because big hydraulic press power, dependability and versatility are major factors in high production output in the aviation industry. These presses are being used for high-pressure rubber pad forming, die quenching, deep drawing, piercing and blanking . . . jobs where versatility must be "built-in", instantly adaptable to varying requirements and countless operations.

Yes, North American is just one of the airframe manufacturers depending on H-P-M presses to keep their production lines humming. For real unit cost reduction, plan your operation around H-P-Ms. Write for details or call in an H-P-M engineer, today.

THE HYDRAULIC PRESS MFG. COMPANY

1042 MARION RD. MOUNT GILEAD, OHIO, U. S. A.

HPM

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
National Machry. Co., Greenfield and Stanton Sts. Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform) Cincinnati 9, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PRESSES, Screw

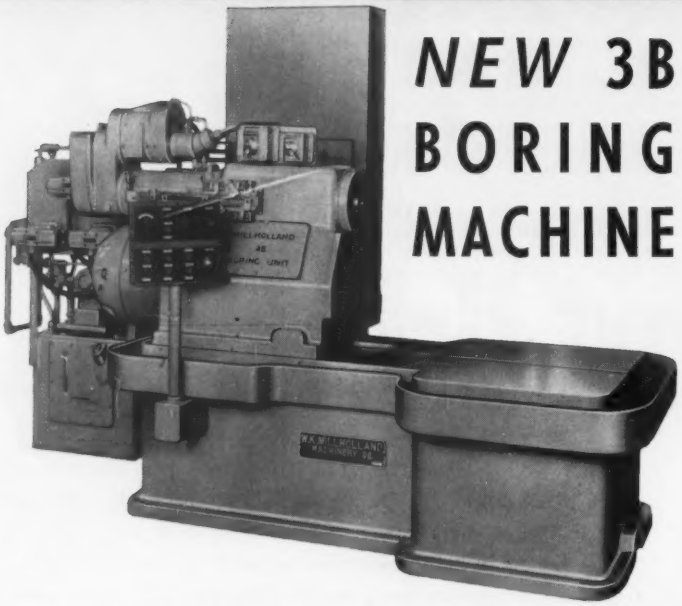
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform) Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.

(*Continued on page 422*)

MILLHOLLAND



NEW 3B BORING MACHINE

TOOL ROOM ACCURACY—The new Millholland 3B Boring Machine uses a standard Automatic Boring Unit with completely automatic feed cycle. Millholland full precision bearing design insures performance to a degree of accuracy equal to that of a conventional horizontal boring mill.

PRODUCTION SPEEDS—Push button operation controls the completely automatic cycle. In addition, separate push buttons control rapid advance, coarse feed, fine feed, dwell, and rapid return. Hydraulic feed mechanism is infinitely adjustable. Machine table is arranged to take any kind of fixture.

LOW CAPITAL INVESTMENT—With the new 3B Boring Machine you can perform many jobs which formerly had to be put on a large and expensive boring mill. On short run jobs especially it will pay for itself in increased economy, efficiency and versatility.

WRITE FOR BULLETIN 111-M

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd., Indianapolis 2, Indiana

For more information on products advertised, use Inquiry Card, page 277

DRAWING KOVAR, a special alloy steel that's considered difficult to draw, is easy with this 35-ton Denison Multipress. And, set-up takes only a few minutes.

Some of the various electronic parts formed by Multipress at Amperex.

Quick die changes with DENISON MULTIPRESS® saves manhours

A way to cut costs on short-run metal-forming

SHORT RUNS, frequent die changes. That was the production problem at Amperex Electronic Corporation, Hicksville, New York.

Now, Denison hydraulic Multipress makes set-ups faster than possible with fixed-stroke presses. With Multipress inching control, the ram can be inched to the convenient point for attaching dies. And the smooth, variable hydraulic stroke gives set-up men perfect control of the ram.

Amperex uses three Multipresses for blanking, piercing, forming, drawing and broaching steel and nonferrous metals . . . to produce a wide variety of shapes and sizes.

This is one example among many where Multipress is cutting costs in the 1-to-75-ton pressure range. For help on your particular application, call a Denison Hydraulic Engineer.

THE
DENISON ENGINEERING COMPANY
1244 Dublin Road, Columbus 16, Ohio

DENISON Hydr OIL ics

HYDRAULIC PRESSES
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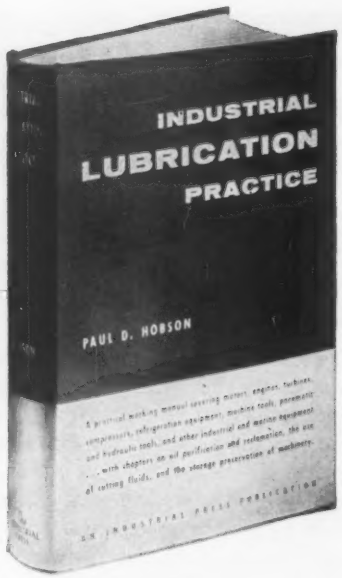

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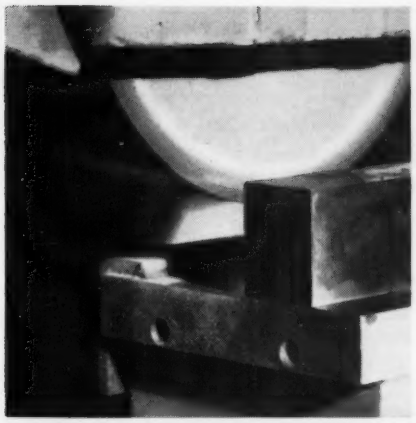

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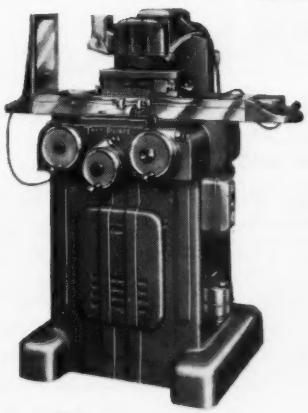
Shows how a Taft-Peirce No. 1 Surface Grinder Repeats to .00005"

Here is a surface grinder so accurate that few people would believe it until this simple demonstration was devised.



Take a side wheel grinding setup. Grind to a zero reading on the cross feed dial. Move the work away one or two thousandths with the cross feed vernier, then back to its original position. NOTE: There's no grinding spark. Now, feed in ½ of a tenth with the vernier and SEE THE GRINDING SPARK.

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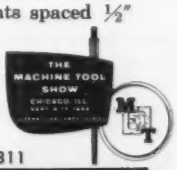
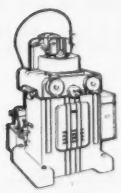
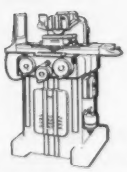
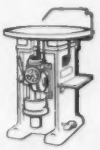


See it in action at the Show Booth 811


Rotary Surface Grinders


Precision Surface Grinders

Lapping Machines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(*Continued on page* 424)

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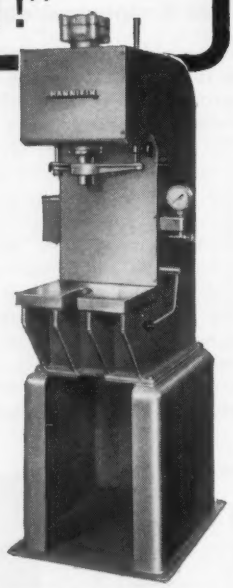

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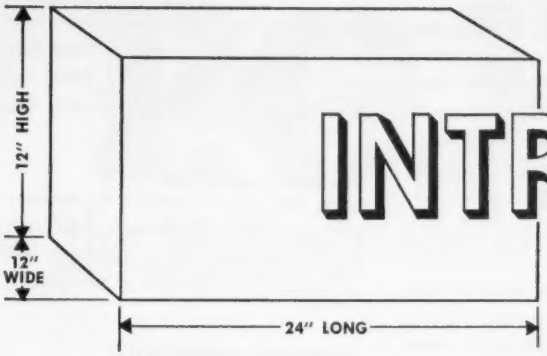

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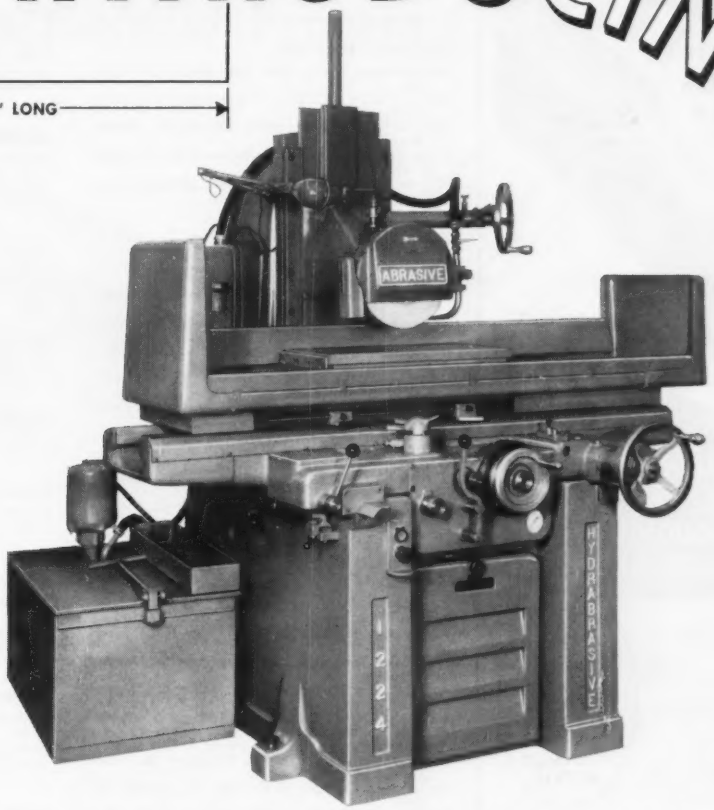

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(*Continued on page* 426)

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Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Wallace Tube Co., (Abrasive) 1304-08 Diversey PKwy., Chicago 14, Ill.

SAWING MACHINES, Friction
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWS, Circular Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SAWS, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAWS, Portable Electric
Millers Falls Co., Greenfield, Mass.

SAWS, Screw Slotting
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

(*Continued on page* 428)

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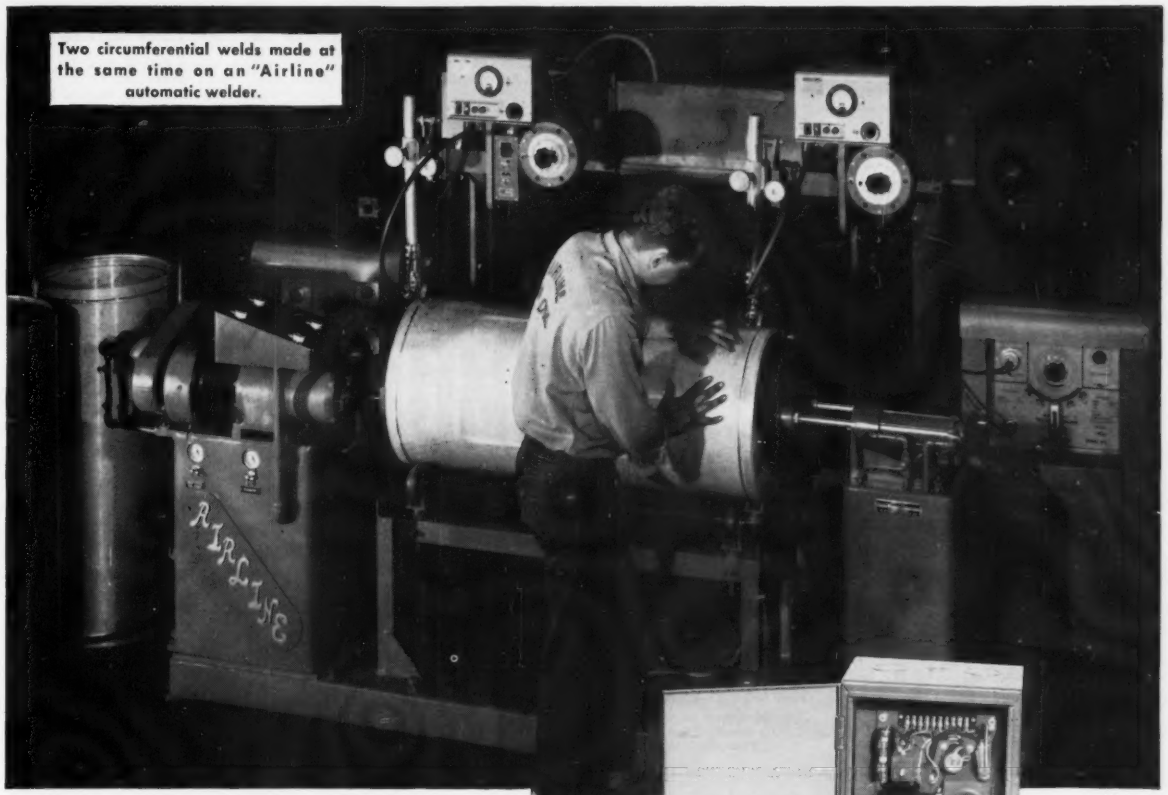

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Clark Bulletin 6520 Magnetic Amplifier Packaged Speed Control consisting of push-button station, control and motor.

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Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P.O. Box 350,
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
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Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co. Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Chicago Screw Co., Bellwood, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New Cork, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease

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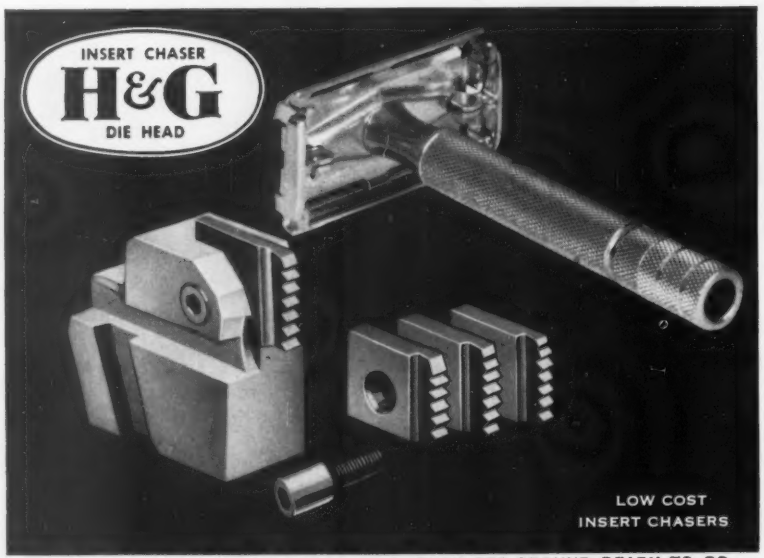
Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co. Box 770, Saginaw, Mich.



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Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAFTS

Jarvis Corp., Middletown, Conn.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

(*Continued on page* 430)

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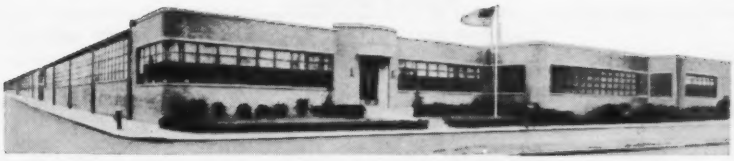

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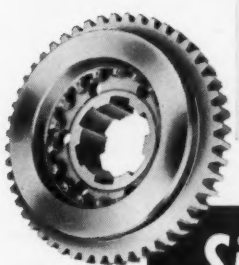

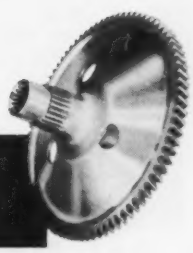

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Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

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Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Structural

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St. Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

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Engineering & Research Corp., Riverdale, Md.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks. 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
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(*Continued on page 432*)

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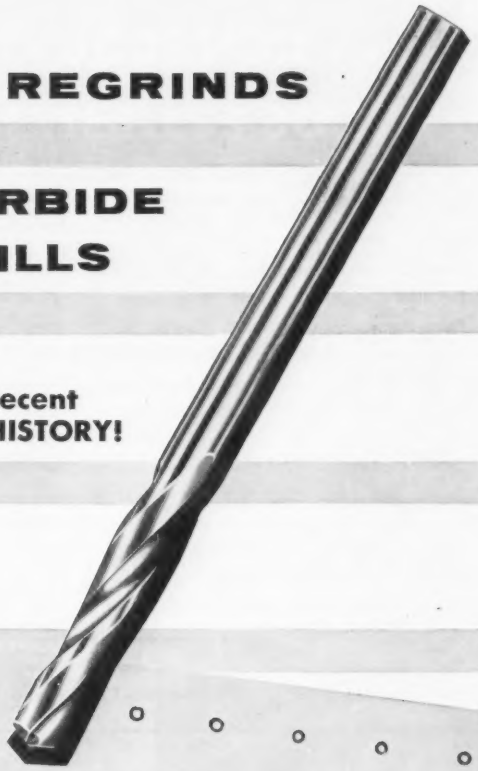

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Consolidated Mch. Tool Corp., Rochester, N. C.
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Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
La Salle Tool Co., Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Tool Co., 7171 E. McNicholas Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

SPINDLES, Boring and Milling

Pope Mchry. Corp., Haverhill, Mass.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Mullins Mfg. Corp., Salem, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

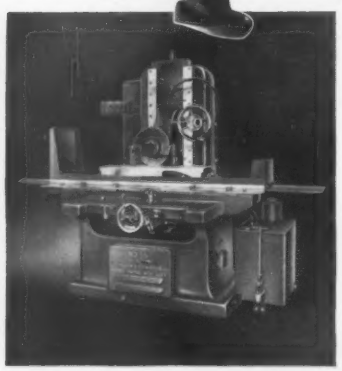
STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

(*Continued on page 434*)

FOUND WHERE WORLD FAMOUS AIRCRAFT ARE "BORN"

GRAND RAPIDS GRINDERS



Grand Rapids No. 55 Hydraulic Feed Surface Grinder
Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

Just take a look in their toolrooms! Every one of these famous aircraft manufacturers uses Grand Rapids Grinders . . . engineered and built for unusual long life of precision grinding. Our Model 55 shown here, for instance, features column and base of massive, one-piece casting for vibrationless rigidity and permanent alignment. Both longitudinal table travel and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. Table speed is variable up to 125 fpm . . . faster than any other of this type and size.

That's why so many tool room men insist on Grand Rapids Grinders.

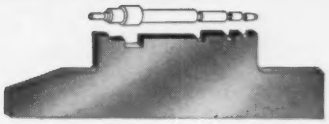
Just a note on your letterhead will bring you full details.

GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON COMPANY 305 Straight Ave., S.W., Grand Rapids, Mich.

For more information on products advertised, use Inquiry Card, page 277

91 days Continuous Production . . . with Talide®-TIPPED CENTERLESS BLADES



LARGE ELECTRIC MOTOR PLANT

PART.....Stainless Steel Rotor Shaft for Electric Motor.

OPERATION.....Grind 7 diameters simultaneously.

MACHINE.....No. 2 Cincinnati Centerless Grinder.

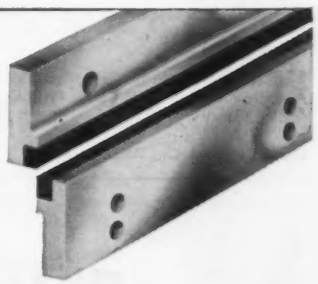
BLADE.....Special multiple step Talide-tipped work support blade No. C-4884.

RESULTS.....Talide-tipped blade in continuous production for 91 days (2 turns per day) compared to best previous production run of 3 days with hard alloy steel blade.

Talide-tipped centerless grinder blades are stocked in over 50 styles and sizes for all types of infeed and thru-feed operations. Special blades for form work including tapered pins and arbors, shafts having multiple diameters, and parts with special contours can be supplied to order. Send print or sketch for quotation.

800,000 CUTS WITH TALIDE SHEAR BLADE!

A leading electrical manufacturer shearing .014" silicon steel for transformers has completely equipped their press line with Talide-tipped blades in lengths ranging from 17" to 64". Blade life is averaging 800,000 cuts per grind compared to 10,000 cuts obtained with steel blades, and customer estimates annual savings of $18,000.



One-piece Talide strip (up to 100" without seams) prevents scoring and scratching. Write for new 84-page Catalog 55-G or ask for sales engineer to call. Metal Carbides Corporation, Youngstown 7, O.

LARGE SAFETY RAZOR COMPANY NETS $20,000 SAVING!

After unsuccessfully experimenting with several other brands of carbide knives, the world's largest razor blade company tested and accepted Talide rotary knives as being far superior to any knife for the gang slitting of razor blade strip steel.

Phenomenal runs of 90 to 1 over hi-carbon, hi-chrome knives and the smoother, burr-free cuts obtained have reduced customer's slitting expense by more than $20,000. Over 1200 coils were gang slitted with Talide knives compared to an average of 15 coils with steel knives. More tonnage was produced in 1 regrind of the Talide knives than over the entire life of a set of steel knives.

Outstanding production runs like this are possible because of the extra dense and porous-free structure of Talide metal. Try Talide blades and knives on your next shearing or slitting job. They're hard to beat and harder to wear out!

METAL CARBIDES CORPORATION

TALIDE®

YOUNGSTOWN 7, OHIO

HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel

STEEL BARS

See Bars, Steel

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCK STOPS

Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

STUD SETTERS

Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

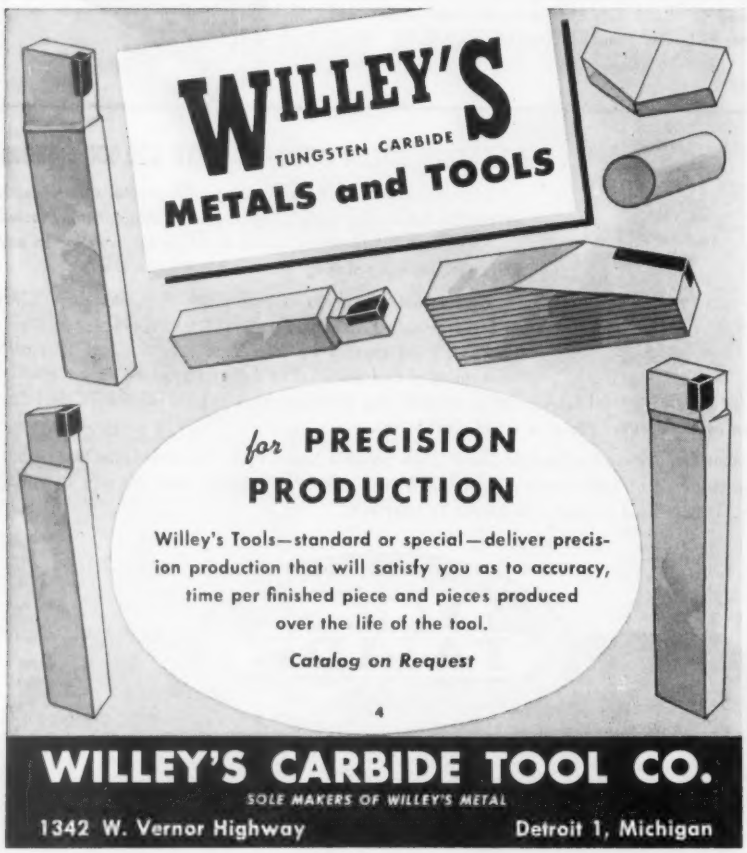
SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE CHECKING EQUIPMENT

Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

(*Continued on page* 436)


WILLEY'S
TUNGSTEN CARBIDE
METALS and TOOLS
for PRECISION PRODUCTION
Willey's Tools—standard or special—deliver precision production that will satisfy you as to accuracy, time per finished piece and pieces produced over the life of the tool.
Catalog on Request
4
WILLEY'S CARBIDE TOOL CO.
SOLE MAKERS OF WILLEY'S METAL
1342 W. Vernor Highway
Detroit 1, Michigan

For more information on products advertised, use Inquiry Card, page 277

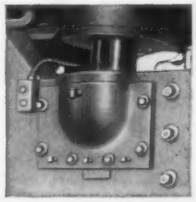
Lodge & Shipley

press brake features

exclusive wedge type ram pressure release

Ram pressure released quickly!

Simple, yet rugged, this exclusive Columbia feature quickly releases ram pressure when the brake is stalled due to an overload condition. After dies are released, the wedges are easily drawn back into position.



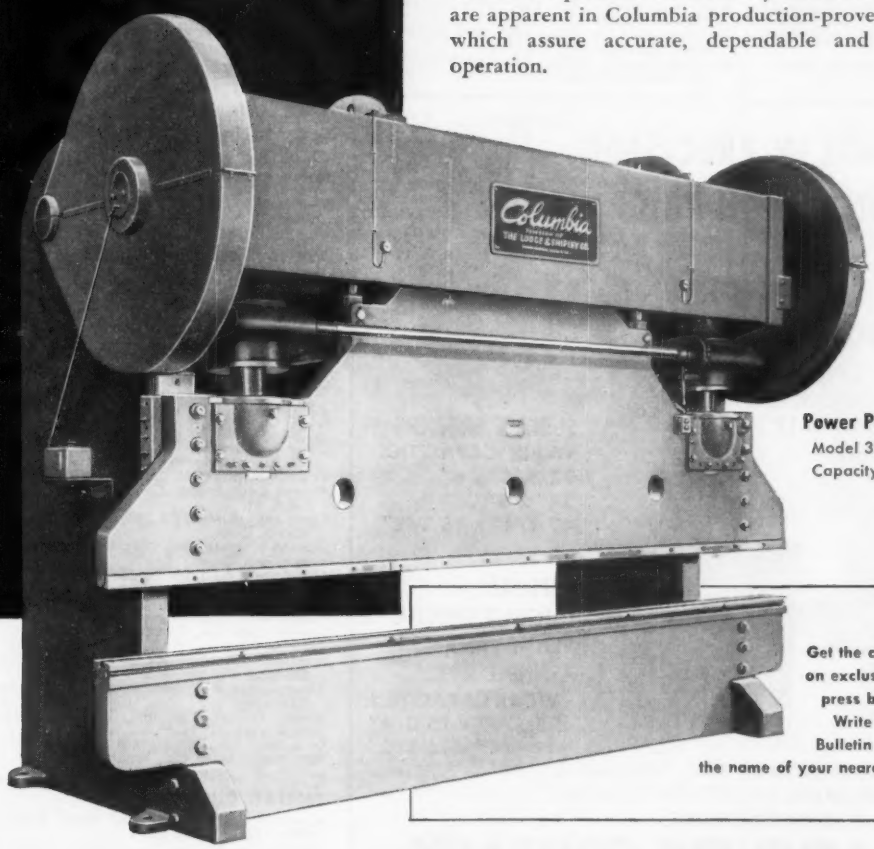
"STUCK" DIES RELEASED QUICKLY and EASILY

...in MINUTES not HOURS!

It's easy to say that a press brake should not be overloaded . . . but occasionally it happens, putting the brake out of operation. If it happens on a Columbia Press Brake, the solution is unusually quick and easy. Pressure is released, and the brake is back in operation in minutes, rather than hours.

The exclusive Columbia Wedge Type Ram Pressure Release is but one of many features on these fine brakes. Among others praised by users for time, money and maintenance savings are: specially designed air clutch and brake and motor-operated micrometer ram adjustment.

Years of experience in the heavy metalworking field are apparent in Columbia production-proved features which assure accurate, dependable and low-cost operation.



Power Press Brake
Model 350—10
Capacity, 10' x ½"

Get the complete story on exclusive Columbia press brake features. Write for new FREE Bulletin No. PB-3 and the name of your nearest distributor.

THE Lodge & Shipley CO.

HAMILTON DIVISION
HAMILTON 1, OHIO

SURFACE PLATES
See Plates, Surface

SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.

SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

TACHOMETERS
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TANGS, Replaceable, Drill & Reamer
Nu-Tangs Inc., 1335 Bates St., Cincinnati, Ohio.

TAPER PINS, Standard
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Topmatic Corp., 845 W. 16th St., Costa Mesa, Cal.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis Corp., Middletown, Conn.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
Barnes Drill Co., 814 Chestnut Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield, Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O-Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Middletown, Conn.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.

TAPS, Collapsing
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

TESTING EQUIPMENT, Tension, Compression, Fatigue, etc.
Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.

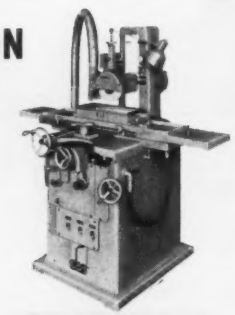
THREAD CUTTING MACHINERY
Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Pierce Mfg., Co., Woonsocket, R. I.

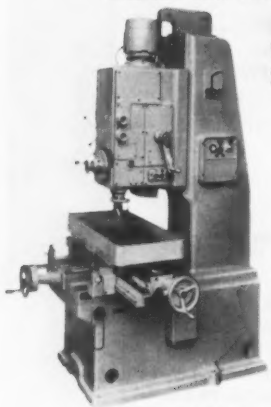
THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.

aba

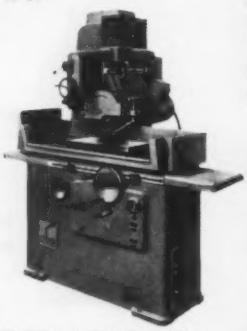
ULTIMATE IN PRECISION
REASONABLE IN PRICE

SURFACE GRINDERS
AND OPTICAL JIG BORER





OPTICAL JIG BORER
WORK CAPACITY:
26" x 17"



SURFACE GRINDERS
WORK CAPACITIES:
13 3/4" x 6"
24" x 8"
49 1/4" x 16 1/2"

SPECIAL
SURFACE GRINDER
WITH VARIABLE
SPINDLE SPEEDS
WORK CAPACITIES:
25 1/4" x 15 3/4"
49 1/4" x 16 1/2"

SOME TERRITORIES STILL AVAILABLE
TO REPUTABLE AGENTS OR DEALERS.
WRITE FOR PARTICULARS.

THE CEE MACHINERY COMPANY

21-25 44th Ave., Dept. M-1 — CEE — Long Island City 1, N. Y.

For more information on products advertised, use Inquiry Card, page 277

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES
See Gages, Thread.

THREAD GRINDING MACHINES
See Grinding Machines, Thread

THREAD MILLING MACHINES
Coulter, James, Machine Co., Bridgeport 5, Conn.
Lees-Bradner Co., Cleveland, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING HEADS
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

THREAD ROLLING MACHINES
Landis Machine Co., Waynesboro, Pa.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp. 20 N. Wacker Drive, Chicago 6, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS
See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL HOLDERS
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St. New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL RESINS
Marblette Corp., 37-33 Thirtieth St., Long Island City 1, N. Y.

TOOL STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St. Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped
Allegheny Ludlum Steel Corp., Pittsburgh, Pa
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Valenite Metals Corp., Box 205, Royal Oak, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer
Allegheny Ludlum Steel Corp., Pittsburgh, Pa
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
du Mont Corp., Greenfield, Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.

(*Continued on page* 438)

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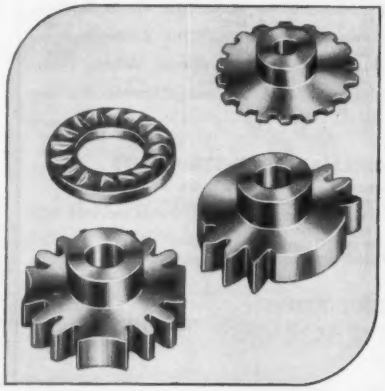

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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General Electric Co., Schenectady, N. Y.

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Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Sillman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

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Abbey-Etna Co., 2444 Maplewood Ave., Toledo 10, Ohio.
American Electric Fusion Corp., 2622 Diversey Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBING, Brass and Copper

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Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

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Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

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Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Leigh Dr., Easton, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.

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Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lehigh Foundries, Inc., 1400 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

VIBRATION INSULATION
American Felt Co., Glenville, Conn.

VISES, Machine
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

VISES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elan and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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General Electric Co., Schenectady, N. Y.

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Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

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Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federal Mch. & Welder Co., Warren, Ohio
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federal Machine & Welder Co., Warren, Ohio.

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duMont Corp., Greenfield, Mass.

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

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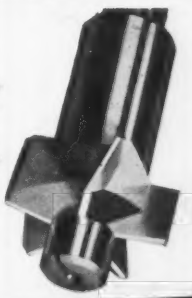

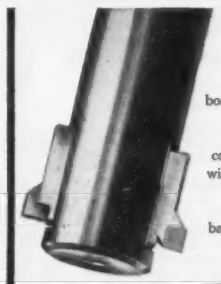

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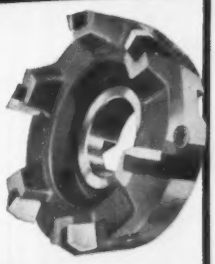

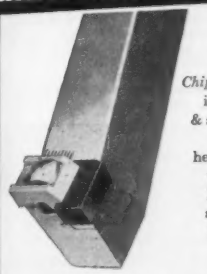

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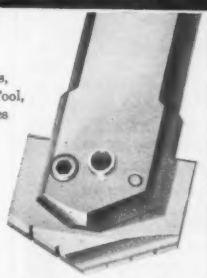

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Tap

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Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

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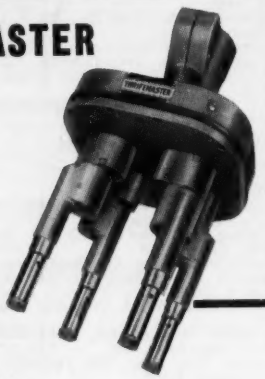

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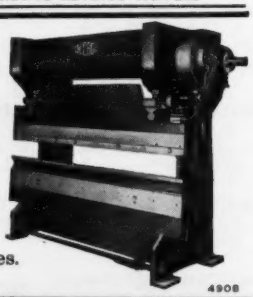

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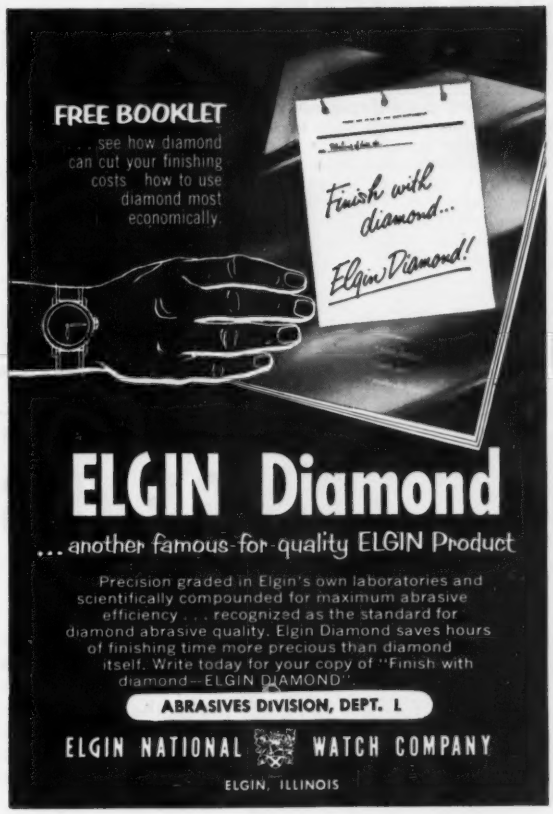
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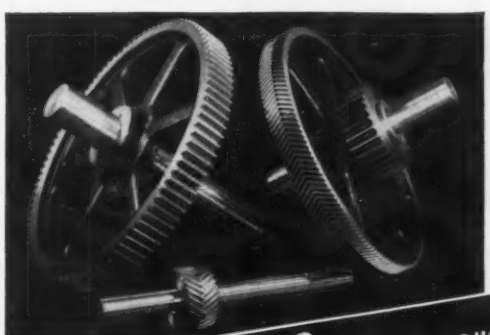

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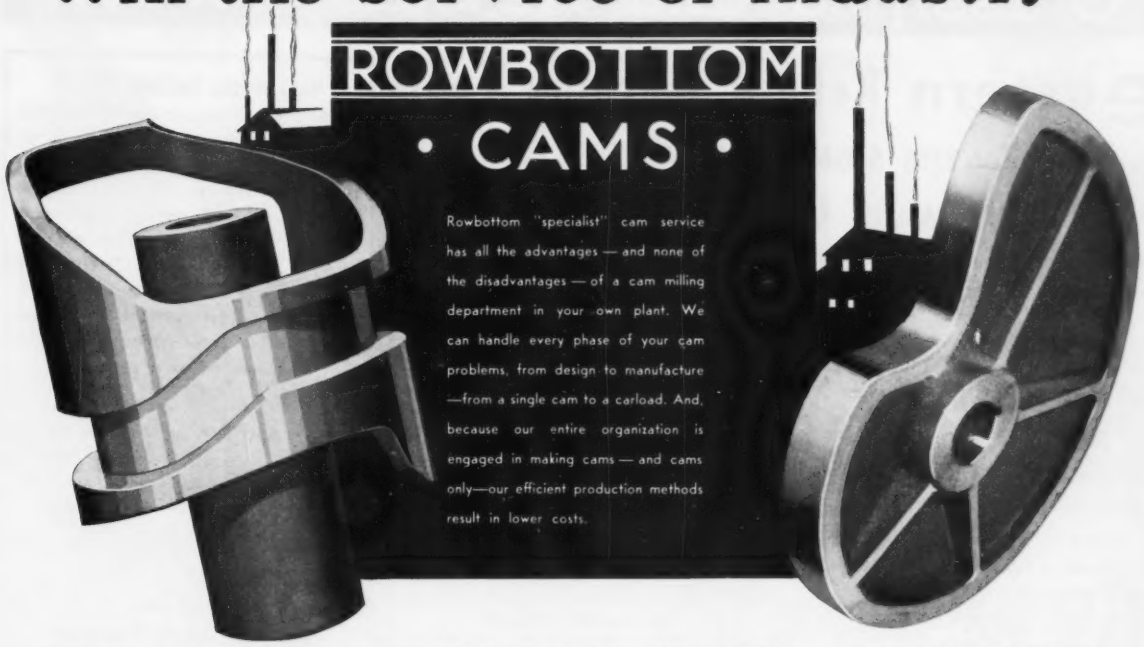

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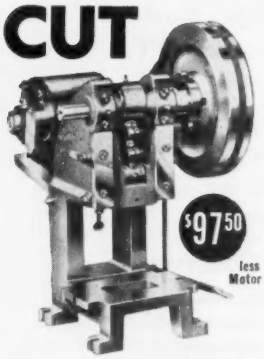

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24" Aurora, m.d.
24" Cincinnati Bickford, m.d.
26" Aurora, m.d., taper
32" Aurora, belt drive
36" Cincinnati Bickford, belt drive
No. 2 Colburn Mfg. Type, m.d.
No. 315 Baker Heavy Duty, s.p.d.
No. 417 Baker, m.d., later type
No. 513 Baker, m.d.
#4-48" Defiance Machine Co. Drill, m.d.

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No. 12 and 18 Fellows Gear Shaving Machines, m.d., late
No. 6 Fellows, belt drive
No. 7, 7A Fellows Gear Shapers, belted, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 61 Fellows, belted, m.d.
No. 61 Fellows, gear box m.d.
No. 61A Fellows, m.d., latest type
No. 64S Fellows, m.d.
No. 645A3 Fellows, m.d.
No. 75 Fellows High Speed, m.d.
No. 75A Fellows, m.d.
No. 712 Fellows, m.d.
No. 4 Fellows Gear Generator, m.d.
No. 715A Fellows High Speed Gear Shaper, m.d.

GEAR CUTTERS

No. 12 Gleason Straight Tooth Bevel Gear Rougher, m.d.
No. 36BM Gould & Eberhardt Spur Gear Cutter
Gleason Spiral Bevel Gear Rougher, m.d.
No. 3—36" Brown & Sharpe Gear Cutter
No. 4B Fellows Gear Burnisher
No. 8B Fellows Gear Burnisher
3" Gleason Gear Generator, m.d.
8" Gleason Gear Generator, m.d.
11" Gleason Gear Generator, m.d.
No. 6-60 Brown & Sharpe Gear Cutter, m.d.
Cincinnati Gear Burnisher, m.d.

GEAR GRINDING MACHINES

6x20" Fitchburg Hydraulic Spline & Gear Grinder, m.d.
9" Pratt & Whitney Hydraulic Spur and Helical
No. 13L8 Fellows Gear Lapper, m.d.
SG11 Gear Grinding Machine, m.d., latest
GG19 Gear Grinding Machine, m.d., latest
GG31 Gear Grinding Machine, Internal Gear & Spline Grinder, m.d.

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18" National Broach Red Ring Gear Lapper, m.d., late

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No. 5AC Lees-Bradner Heavy Type Gear Generator, m.d.
No. 12 Barber-Colman Double Overarm, m.d.
No. 12 Barber-Colman Single Overarm, m.d.
No 34 Brown & Sharpe, m.d., Spur & Spiral
No. 44 Brown & Sharpe, m.d.
#130 Cleveland Rigid Hobber

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12" National Broach & Machine Co.
18" National Broach & Machine Co.
18" Gleason Bevel Gear Tester, m.d.
No. 471 Michigan Tool Co. Hob, Reamer & Gear Checker

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Kwick-Way Model H Piston Turning & Grinding Machine, m.d.

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No. 3 Cincinnati, m.d.
Cincinnati Valve Seat Grinder, cap. ⅝" valve seat, m.d.

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No. 121 Hanchett Production Face Grinder, type BD, m.d.
No. 33 Abrasive Vertical, m.d.
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GRINDERS, CYLINDRICAL, 10" x 18" Cincinnati ER plain hyd., 1946.
GRINDERS, CYLINDRICAL, 16" x 72" Norton C, swing 26", new 1945.
GRINDERS, CYLINDRICAL, 16" x 96" Landis type B, 48" gap, new 1941.
GRINDERS, SURFACE, 14" x 36" Pratt & Whitney vert spdl., 1942.
GRINDERS, SURFACE, 43" No. 16A2 Blanchard rotary, new 1947.
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary, new 1946.
GRINDERS, TOOL & CUTTER, No. 13 Brown & Sharpe universal, new 1942.
LATHES, ENGINE, 14" x 6' bed Hendey toolroom, Timken, 1940.
24" x 48" Monarch, Toolroom, 1942
LATHES, ENGINE, 24" x 20' bed Leblond H.D. G.H., older.
LATHES, TURRET, No. 5 Jones & Lamson universal (2), 1939.
LATHES, TURRET, 36" and 42" Bullard New Era vertical.
MILL, No. 3-H Kearney & Trecker plain, horizontal, new 1942.
MILL, 24" x 24" x 12' Ingersoll adj. rail, tracer, new 1945.
MILL, Nos. 3K and 4K Kearney & Trecker, rebuilt.
MILL, Nos. 2-4 and 5 Cincinnati Hi power plain.
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PRESS, 180 Ton 784G Verson gap Frame, air clutch, 32 x 100 B.A.
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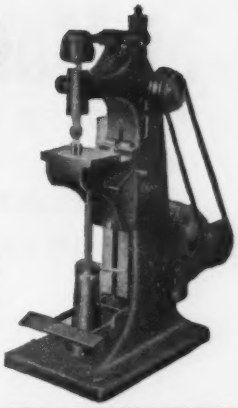

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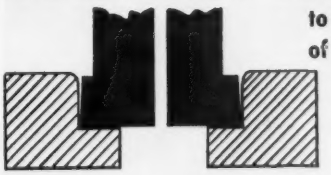

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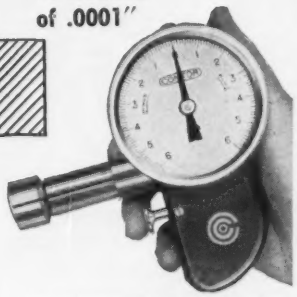

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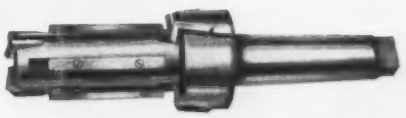

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For more information on products advertised, use Inquiry Card, page 277

ALPHABETICAL INDEX OF ADVERTISERS

A

Abbey Etna Co. 311
Abrasive Machine Tool Co. .. 423
Allegheny Ludlum Steel Corp. 118
Allen, Alva F. 443
Allen-Bradley Co. Insert bet. 44-45
Allen Manufacturing Co. 317
American Brass Co. Insert bet. 70-71
American Broach & Mch. Co. ..... Insert 87-104
American Chain & Cable 362
American Steel Foundries 275-287
American Tool Works Co. .. 145
Apex Tool & Cutter Co., Inc. 445
Armstrong-Blum Mfg. Co. .. 106
Armstrong Bros. Tool Co. 130
Arter Grinding Mch. Co. 370
Atrax Co. 431
Austin Industrial Corp. 406
Automotive Gear Works, Inc. 301
Avey Drilling Mch. Co. 26-27
Axelson Manufacturing Co., Div. U. S. Industries, Inc. 320

B

Baker Brothers, Inc. 347-441
Baldwin-Lima-Hamilton Corp. 408
Barber-Colman Co. Insert 87-104
Barnes Drill Co. .... Insert 87-104
Barnes, W. F. & John Co. Insert 87-104
Baush Machine Tool Co. 52
Bethlehem Steel Co. 117-119
Birdsboro Steel Foundry & Machine Co. 308
Blanchard Machine Co. 56
Bliss, E. W., Co. 63
Bodine Corporation 325
Boston Gear Works 314
Bridgeport Machines, Inc 146
Brown & Sharpe Mfg. Co. 253
Bryant Chucking Grinder Co. 137-401
Bryant Machinery & Engineering Co. 265
Buffalo Forge Co. 374-375
Buhr Machine Tool Co. 263
Bullard Co. ..... Insert bet. 33-36
Bunting Brass & Bronze Co. 334
Butterfield Div., Union Twist Drill Co. 45

C

Carboloy Dept. of General Electric Co. .. 107-108-109-110
Carborundum Co. 38-39
Card, S. W., Mfg. Co. 149
Carlton Machine Tool Co. 58-59
Cee Machinery Co. 436
Chicago Pneumatic Tool Co. 36
Chicago Screw Co. 405
Cincinnati Bickford Tool Co. 251
Cincinnati Gear Co. 426
Cincinnati Gilbert Mch. Tool Co. 148
Cincinnati Lathe & Tool Co. 288-289
Cincinnati Milling Machine Co. 6-7
Cincinnati Milling Machine Co. (Hydroform) 71
Cincinnati Milling Products Div., Cincinnati Milling Machine Co. 30-31
Cincinnati Shaper Co. 74-75
Circular Tool Co., Inc. 380
Cities Service Oil Co. 323
Clark Controller Co. 427
Classified Advts. 444
Clearing Machine Corp., Div. U. S. Industries Inc. 69
Cleereman Machine Tool Co. 265
Cleveland Crane & Engrg. Co. 66
Cleveland Instrument Co. .. 384
Cleveland Twist Drill Co. Insert 53
Cleveland Worm & Gear Co. Inside Back Cover
Colonial Broach Co. 76
Columbus Die-Tool & Mch. Co. 405
Comtor Co. 445
Cone Automatic Mch. Co., Inc. 131
Consolidated Machine Tool Co. 128-129
Cosa Corp. 140
Crane Packing Co. 387
Cross Company 267-268
Crucible Steel Co. of America 111-113
Cumberland Steel Co. 122
Cushman Chuck Co. 321

D

Danly Mch. Specialties, Inc. 47-388-389
Davis & Thompson Co. 386
Davis Keyseater Co. 442
DeLaval Separator Co. 367
Delco Products, Div. of General Motors Corp. 42-43
Denison Engineering Co. 419
Diefendorf Gear Corp. 442
Dreis & Krump Mfg. Co. 440
du Mont Corporation 437
Dykem Co. 443

E

Eastern Mch. Screw Corp. 428
Eastern Machinery Co. 444
Eastman Kodak Co. 395
Eaton Manufacturing Co., Reliance Div. 363
Eclipse Counterbore Co. 368
Edlund Machinery Co. 443
Eisler Engineering Co., Inc. 443
Ekstrom, Carlson & Co. Insert 87-104
Elgin National Watch Co. 441
Elmes Engineering Div., American Steel Foundries 275
Elox Corp. of Michigan 353
Engineering & Research Div. of A C F Industries Inc... 300
Errington Mechanical Laboratory, Inc. 404
Ex-Cell-O Corporation .. 261-285

F

Fafnir Bearing Co. 281
Falk Machinery Co. 444
Federal Machine & Welder Co. 356
Federal Products Corp. 41
Fellows Gear Shaper Co. 4-5
Ferracute Machine Co. 410
Firth Sterling, Inc. 377
Fischer Machine Co. 440
Fiske Bros. Refining Co., Lubriplate Div. 376
Foote-Burt Company 32
Fosdick Machine Tool Co. 336-337
Frew Machine Co. 440
Fulmer, C. Allen, Co. 394

G

Gairing Tool Co. 439
Gallmeyer & Livingston Co. 432
Gardner Machine Co. 22-23
Garlock Packing Co. 354
Gear Grinding Machine Co. 302-303
Gear Specialties, Inc. 271
General Electric Co. 312-313-335
Giddings & Lewis Machine Tool Co. 20-21
Gisholt Machine Co. 46-136
Gleason Works 141
Goss & DeLeeuw Mch. Co. .. 328
Grant Mfg. & Machine Co. .. 445
Gray, G. A., Co. 60
Greenfield Tap & Die Corp. Insert bet. 130-131
Greenlee Bros. & Co. Insert 87-104

H

Hamilton Div., Lodge & Shipley Co., The 435
Hannifin Corporation 381-422
Hardinge Brothers, Inc. 152
Haynes Stellite Div., Union Carbide & Carbon Corp. 112
Heald Machine Co., The Inside Front Cover
Heller Brothers Co. 373
Holmes, Stanley H., Co. 404
Howell Electric Motors Co. .. 358
Hunt, C. B. & Son, Inc. 330
Hydra-Feed Mch. Tool Corp. 283
Hydraulic Press Mfg. Co. 417
Hydropress, Inc. 385

I

Illinois Gear & Machine Co. 142
Industrial Press 420
Ingersoll Milling Machine Co. ..... Insert 87-104
Ingersoll-Rand Co. 393
International Nickel Co., Inc. 116

J

Jacobs Mfg. Co. Front Cover-364
Jones & Lamson Machine Co. ..... Insert bet. 32-33

K

Kearney & Trecker Corp. .. 18-19
King Machine Tool Div., American Steel Foundries 287
Kingsbury Machine Tool Corp. 72-73

L

Lake Erie Engineering Corp. 84-85
Laminated Shim Co., Inc. Insert 105
Landis Machine Co. 2-3
Landis Tool Co. 10-11
Lapmaster Div., Crane Packing Co. 387
Lapointe Machine Tool Co. .. 315
LeBlond, R. K., Machine Tool Co. 132-133
Lees-Bradner Co. 318
Leland-Gifford Co. 446
Lempco Industrial, Inc. 379
Lincoln Electric Co. 316
Linde Air Products Co., Div. Union Carbide and Carbon Corp. 33
Lipe-Rollway Corp. 342
Lobdell United Div., Engineering & Foundry Co. 352
Lodge & Shipley Co., The 359
Lubriplate Div., Fiske Bros. Refining Co. 376
Lucas Machine Div., New Britain Machine Co., The Insert facing 123, 124-125
Luers, J. Milton 445

M

Macklin Co. 403
Madison-Kipp Corp. 399
Mahon, R. C., Co. 327
Massachusetts Gear & Tool Co. 438
Materials Section 107-122
Mattison Machine Works Insert 87-104
Mercury Engineering Corp. .. 355
Metal Carbides Corp. 433
Micromatic Hone Corp. 68
Micrometrical Manufacturing Co. 402
Miles Machinery Co. 444
Millers Falls Co. 338
Millholland, W. K., Machinery Co., Inc. 418
Minster Machine Co. 343
Mitts & Merrill 441
Mohawk Tools, Inc. 378
Moline Tool Co. 416
Monarch Machine Tool Co. 295-397
Morris Machine Tool Co. 290-291
Motch & Merryweather Mchry. Co. 134
Mueller Brass Co. 329
Mullins Mfg. Corp. 425
Mummert-Dixon Co. 445

N

National Acme Co. 37-67
National Automatic Tool Co., Inc. 65
National Broach & Mch. Co. 127
National Forge & Ordnance Co. 114
National Machine Tool Builders' Assoc. 351
National Machinery Co. 294
National Tube Div., United States Steel Corp. 411
National Twist Drill & Tool Co. 17
Nebel Machine Tool Co. 64
New Britain Machine Co., The Insert facing 123, 124-125
Newcomer Products, Inc. 424
New Departure, Div. General Motors 70
New Jersey Gear & Mfg. Co. 443
New Jersey Zinc Co. 120
Niagara Machine & Tool Works 80-81
Nichols-Morris Corp. 310
Norton Company 14-15-82-83

O

Oakite Products, Inc. 115
Ohio Crankshaft Co. 57
Oilgear Co. 369
Oliver Instrument Co. 344
Orange Roller Bearing Co. Inc. 319
Osborn Mfg. Co. 400
Ottemiller, William H., Co. .. 442

ALPHABETICAL INDEX OF ADVERTISERS

P

Pangborn Corporation 448
Parker-Kalon Div., General American Transportation Corp. 44
Parker Rust Proof Co. 298
Philadelphia Gear Wks., Inc. 48
Pope Machinery Corp. 396
Potter & Johnston Co. 299
Pratt & Whitney Div., Niles-Bement-Pond Co. 61
Precision Tool & Mfg. Co. .. 346
Procunier Safety Chuck Co. 440
Production Engineering Show 350
Producto Machine Co. 293

R

Reed Rolled Thread Die Co. 392
Rehnberg-Jacobson Mfg. Co. Insert 87-104
Reid Bros. Co., Inc. 139
Revere Copper & Brass, Inc. 257
Richard Bros. Punch Div., Allied Products Corp. 339
Rockford Clutch Div. of Borg-Warner 414
Rockford Machine Tool Co. Insert 87-104
Rowbottom Machine Co. 443
Russell, Burdsall & Ward Bolt & Nut Co. 276
Russell, Holbrook & Henderson, Inc. 413
Ruthman Machinery Co. 430
Ryerson, Joseph T. & Son, Inc. 154

S

Scott Paper Co. 340-341
Schrader's A., Son., Div., Scovill Mfg. Co., Inc. 391
Scully-Jones & Co. 50-51
Seneca Falls Mch. Co. 126
Sheffield Corp. 304-305
Sheldon Machine Co., Inc. 390
Shell Oil Co. 345
Shore Instrument & Mfg. Co., Inc. 442
Sidney Machine Tool Co. 255
Sier-Bath Gear & Pump Co., Inc. 429
Simonds Abrasive Co. 147
Simonds Saw & Steel Co. 143
Sinclair Refining Co. 297
Smit, J. K. & Sons, Inc. 366
Snyder Tool & Engrg. Co. 28-29
Socony Mobiloil Co., Inc. 309
South Bend Lathe Works 360
Stahl Gear & Machine Co. 441
Standard Gage Co., Inc. 86
Standard Oil Co. (Indiana) 357
Standard Pressed Steel Co. 40
Sun Oil Co. 77-78-79
Sundstrand Machine Tool Co. ..... Insert 87-104
Sunnen Products Co. 258
Super Tool Co. 383
Swanson Tool & Mch. Products, Inc. 409

T

Taft-Peirce Mfg. Co. 62-292-421
Texas Company 150
Thompson Grinder Company 135
Threadwell Tap & Die Co. 331
Thriftmaster Products Corp. 440
Timken Roller Bearing Co. Back Cover
Timken Roller Bearing Co. Steel & Tube Div. 121
Twin Disc Clutch Co. 326

U

U. S. Burke Machine Tool Div. 296
U. S. Tool Company, Inc. 12-13
Union Carbide & Carbon Corp., Haynes Stellite Co. 112
Union Carbide & Carbon Corp., Linde Air Products Co., Div. 33
United States Drill Head Co. 415
United States Steel Corp. 411
Universal Engineering Co..... 55
Used Machinery 444

V

Van Keuren Co. 130-A
Van Norman Co. 8-9
Vanadium-Alloys Steel Co. .. 349
Verson Allsteel Press Co. 144
Vickers, Inc. 361
Viking Pump Co. 438
Virginia Gear & Mch. Corp. 48

W

Wade Tool Co. 54
Waldes Kohinoor, Inc. 371
Wales-Strippit Corp. 365
Walker, O. S., Co., Inc. 412
Wallace Supplies Mfg. Co. .. 445
Walls Sales Corp. 372
Waltham Machine Works 442
Warner & Swasey Co. 24-25
Wesson Company 273
Westinghouse Electric Corp. 332-333
White & Bagley Co. 348
Whitman & Barnes, Inc. 324
Wicaco Machine Corp. 382
Wiedeman Machine Co. 306-307
Willey's Carbide Tool Co. 434
Williamson Gear & Mch. Co. 445
Wilson Mechanical Instrument Div., American Chain & Cable 362
Wing, L. J., Mfg. Co. 322
Winter Brothers Co. 16
Wood, R. D., Co. 49

Y

Yoder Company 138
Young Machine Tool Div. 398

Z

Zagar Tool, Inc. 407

CLASSIFIED SECTION
See page 406

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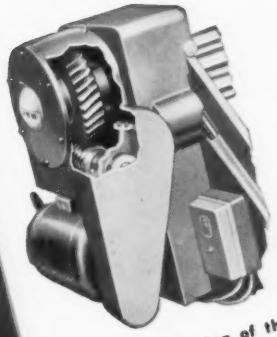

● Cutaway section of this bending roll at left shows the Cleveland worm gearing which drives the rolls that form steel sheets into cylinders.
Illustration courtesy of Wysong and Miles Company.

CLEVELAND worm gearing—efficient for life

INSIDE this new Wysong 5" Bending Roll, Cleveland worm gearing drives the rolls that form steel sheets into cylinders. And although gear life will be a series of split-second starts and stops under load, it will operate dependably *for years* because Cleveland worm gearing never loses its efficiency!

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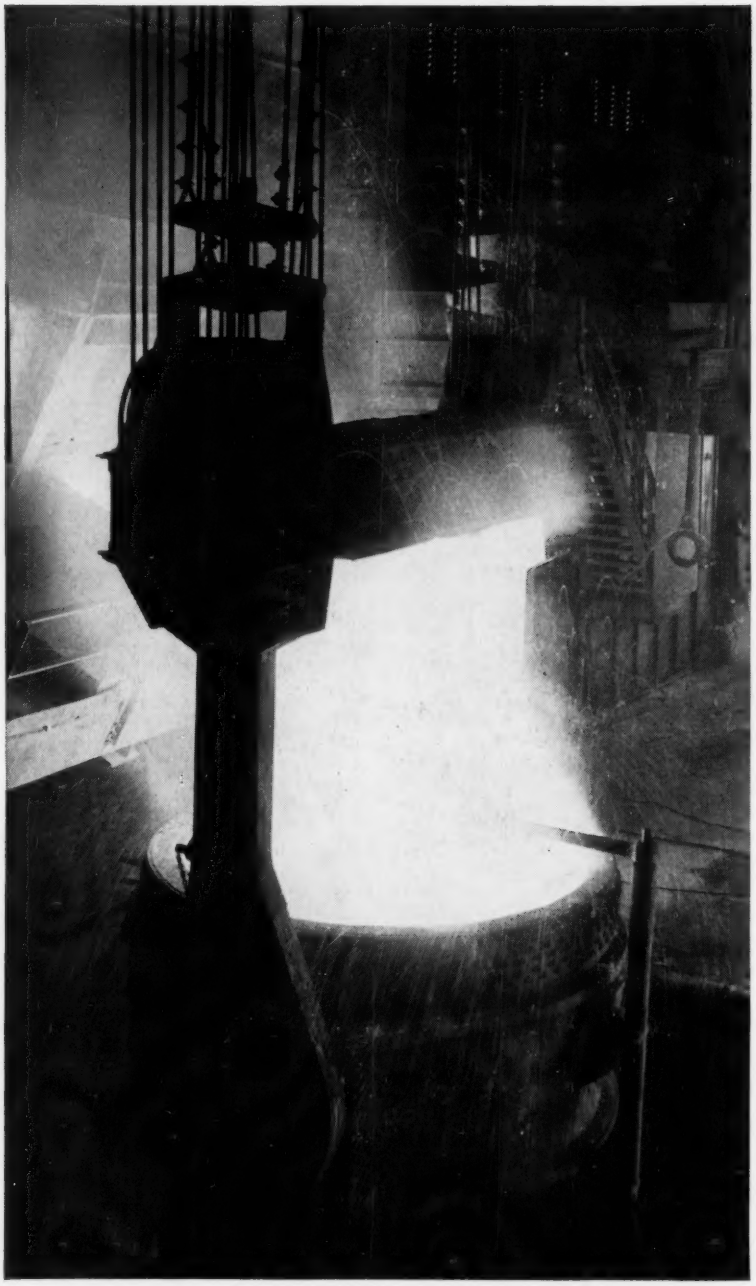
CLEVELAND
Worm Gear
Drives

We make our own fine alloy steel—and make it nickel-rich—to make TIMKEN® bearings tougher



NICKEL makes steel tougher. So, our steel-making specialists don't skimp on nickel in the fine alloy steel we make for Timken® tapered roller bearings. They use exactly the right amount of nickel to give these bearings the toughness they need to withstand shock and last longer. Exacting quantities of chromium or molybdenum or both guarantee uniform hardness. By using the steel industry's first direct-reading spectrometer, we exercise hairline control of each element at the precise instant of tapping the furnace.

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We've been specializing in the production of fine alloy steel for almost forty years. We're the only bearing manufacturer in the country that makes its own steel, because it's the only way we can make sure the quality of our bearing steel is just the way we want it. Steel is the heart of the bearing. That's why we insist on controlling bearing quality *every* step of the way—from melt shop to final bearing inspection. And that's why we don't skimp on the use of nickel.

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TIMKEN BEARING EQUIPPED

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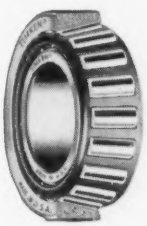
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